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HOME HEALTH LIBRARY

A Presentation of Modern Methods of Health-Building

By

BERNARR MACFADDEN
And Other Health Authorities

VOLUME I

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FOREWORD

IN presenting this work an ambition that has existed for a long time has been realized. That is, the placing within the reach of everyone at a low price of a strictly up-to-date work containing in simple, understandable, non-technical phraseology a complete presentation of the subjects of health building and health maintenance. This set of books, when studied and tested, should make new men and women of its readers, full of vitality, endurance, resistance and dynamic, buoyant health.

With health one becomes a conqueror. Imaginary obstacles are quickly overcome. With health one can enjoy every aspect of life. One then becomes an optimist; while without health one is frequently miserable, depressed and pessimistic.

Many people have the impression that building dynamic, powerful health requires an interminable amount of hard work, exhausting exercises, privation diets and sacrifices of all kinds.

Instead, the very practices involved in maintaining a vigorous, vital body are a source of joy and happiness. The more enthusiastic one becomes the more one realizes what this condition of health means to himself and to others.

Vitality, virility, personality, happiness, success—these are but a few of the invaluable possessions which health brings.

The medical profession is giving more and more attention to the matter of dietetics and to the benefits to be derived from sunlight, fresh air, exercise, and proper eating and less and less attention to the treatment of symptoms by drugs, few of which are specifics. Today, in the field of medicine, scientists and research workers are bending every effort to discover means for the prevention of disease by establishing immunity. This makes one realize that the prevention of disease is a goal towards which all mankind should be heading.

The way to prevent disease is to increase power of resistance and to establish a natural immunity by proper living.

For the past fifty years I have been preaching and teaching these immutable laws of life. It has taken a long time to make people accept the truth of these statements. But Nature's methods, which

we are endeavoring to interpret as nearly as possible, are being recognized and endorsed by increasing thousands.

The Home Health Library is designed to provide an education in health-building. It embraces many subjects such as the structure and the functions of the human body, developmental and corrective exercises, foods, the control of body weight, the building of beauty and personality, marriage, childbirth, the care of children, hydrotherapy, physiotherapy, diets, first aid, and the causes, and symptoms of common disorders. It includes also a complete presentation of the natural measures used in the management of disease.

Yet all this is given clearly, concisely and compactly and is set forth so plainly that no one will find it too technical or non-understandable.

It is a privilege to present this work on the value and importance of proper living.

Bernarr Macfadden

For Immediate Reference

HOME HEALTH LIBRARY

IT is the purpose of this set of books to begin with simpler facts and to advance to progressive study of various subjects related to health. These various subjects are grouped in divisions. One or more such divisions is included in each volume of this work. Thus each volume deals with one or more divisions of the principles of health-building.

Alphabetical arrangement is applied so far as practicable, to each of such divisions. Alphabetical arrangement has been applied particularly to ailments and injuries listed in Volume II.

For immediate reference to any topic related to health, the index appearing on the pages following enables the reader to ascertain the page upon which the desired information appears.

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Home Health Library
Volume I

PART 1

THE BODY AND ITS STRUCTURE

MAN'S mentality, from prehistoric times, has tended to grow more acute, while his instincts have dulled. Intelligence has not always effectively replaced vanishing instinct, and so were born such catch-phrases as the adage proclaiming that man grows weaker and wiser.

Such an assumption is entirely unwarranted. On the contrary, natural instincts, plus intelligence, should enable man to grow stronger and wiser.

Let us consider some of the most important of the instincts involved in human life. First, we may list the use of foods adapted to man's needs. As second, we may include mating. As third, we may list the development of physical skill and endurance by persistence, and as fourth, dependence on the forces of Nature to overcome weakness and disease.

Simple as such a classification may seem, it might be simplified further. For all the instincts mentioned, save only mating, may be considered as part of what has been declared Nature's first law, self-preservation.

It may be noted that these instincts, almost in the sequence they are here given, form the subject matter of the two volumes before you. Nor is this a matter of accident. Indeed, instinct has an important bearing upon the building of health as presented in these pages.

Natural Methods of Health-Building.—It is not strange that natural methods of health-building should stress the importance of human instinct. Natural methods of building health employ, for the most part, forces of Nature to which man turns by instinct. These forces of Nature produce effects as impressive to the sophisticated

man of today as they were to his primitive ancestors. This should explain the intuitive turning of man toward these forces.

Throughout centuries of recorded history and long before them, incantations and decoctions have had their day. Yet mentalities in many eras have held confidence in the power of Nature to cure when its forces have been properly applied.

Passing from opinion to practical action, it has been proved again and again that instincts, although latent, still may point the way to health.

Food and Instinct.—Demand for food is recognized as a primary instinct in all living creatures. With man, at least, we may go further, and also recognize his desire for certain forms of food as a result of instinct. Fresh fruits and vegetables are types of such foods.

This instinct seems to be largely responsible for the wide range of foods comprising man's diet when such choice is possible. Even prior to the corroboration given to such beliefs by science, the impressions prevailed in many quarters that when the diet is restricted or is lacking in variety, havoc to health may result.

Weakness and disease result from the absence of body elements provided in minute quantity, here and there, by varied foodstuffs. Instinct indicated this fact, probably earlier than human record.

Yet science only recently added the confirmation of intelligence to this fact.

That grains and other foodstuffs in natural and unchanged state, best promote vitality, and that mineral salts and what are now called the vitamins are essential to health, also remained long unnoted. Primitive food instinct pointed the way to health, but intelligence was laggard in its awakening to the truth.

Instinct and Nature's Forces.—That the sun's rays are a vitally important factor in man's health has long been recognized, although not understood. In sunny lands, as an instance, an abundance of sunshine overcomes food-deficiency that might otherwise cause rickets and its accompanying deformities in hosts of children.

Still, intelligence and science long failed to recognize the connection between cause and effect in this matter.

Until thirty years ago investigators in the field of sunlight as a cure for disease were few and far between. In the course of the past generation we have learned that sunlight, whether natural or artificial, may be utilized to remedy many human disorders.

The instinct to utilize the sun's rays as a source of comfort has long

been in evidence in man. It required awakened intelligence to interpret instinct and to apply sunlight to the mending of the maimed and relief of suffering.

Intelligence and Instinct.—These brief outlines are examples of today's trend toward combining intelligence and instinct in health-building.

Step by step with the details of these advances in human knowledge —details without which this set of books hardly could fulfil its complete purpose—the actual application of instinct to health is made plainer to us. Simultaneously the important relationship between intelligence and instinct is made clear.

Today a work on building health by the forces of Nature must, to serve its purpose, differ widely from books of the past on such subjects. It is true that the actual procedures to be applied are similar. Yet they are so far extended, and the uses made of them are so much more definite, that a wide gulf is created.

What in the past might have been regarded as opinions of an individual may be stated today as proved facts. Science has demonstrated that natural treatments have the right to serious consideration and to extensive application.

Degrees of Health.—To one interested in the possibilities of health, a marked line of cleavage appears to separate two great groups in the ranks of healthful humanity. By far the larger of these two groups is characterized by what may be called neutral health. This resistant or protective degree of health is the logical outcome of "a condition of soundness," an excellent textbook definition of health.

The second and smaller group is marked by health of a more vigorous degree. In this group resistance is developed as well as vitality and energy. This degree of health not only maintains one's existence at the normal, it effects important results mentally and physically. Indeed it changes the life of its possessor in innumerable details. This condition we may call positive health.

Where neutral health exists, the possession of positive health is possible.

Neutral health enables the body to develop protective resistance against disease, and keeps one fit for life's tasks and recreations. Positive health accomplishes the same purposes, and in addition develops abundance of mental and physical energy.

Most important of all is the fact that the choice between neutral and positive health is the result of one's own volition, and depends upon health instinct and health intelligence.

Intelligence and Health.—As man lives today, health-intelligence and its practice are essential to maintaining health. To be sure, intelligence is essential in business and social activities, but where health is concerned the distinction is that not only is intelligence necessary but practice must go hand in hand with it. In deep water, where one must swim or drown, knowledge of the principles of swimming is not sufficient. One must be able to apply that knowledge or one must pay the penalty.

Intelligence to a great extent has replaced instinct in modern life. The bird that soars in the teeth of the wind is guided chiefly by instinct. The human flyer performs the same feat in an airplane by intelligence plus physical concentration.

Man's Physical and Mental Structure.—The axiom sponsored by many sages, "Know Thyself," has perhaps a more direct application to the study of health than to any other form of human knowledge.

The first step toward health-intelligence is an understanding of the structure of the various parts of the body and of the work that each of these parts must perform to maintain health.

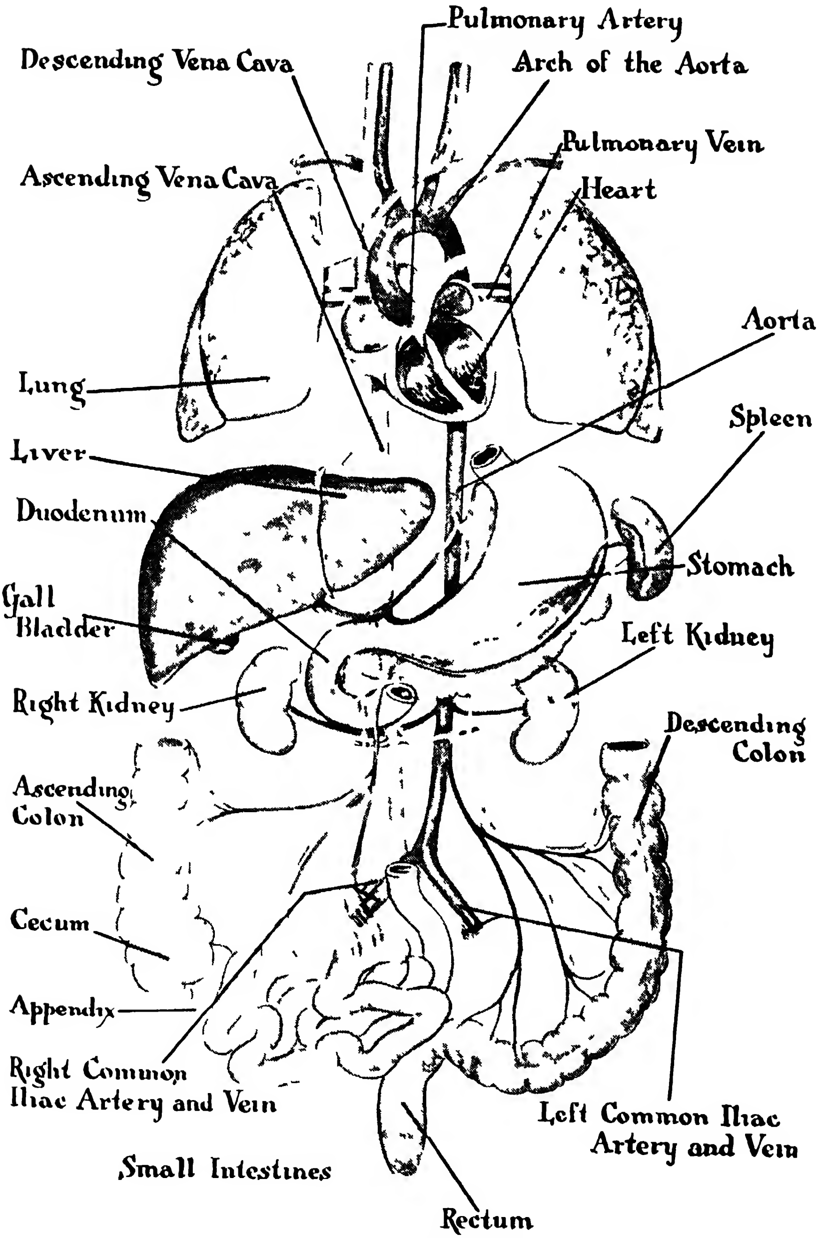
The human body is at once chemical laboratory and intricate machine. As such, its operations naturally exhibit many complex details. This is true in greater or lesser degree of all forms of animal existence—indeed, of life in general.

Anatomy and Health-Intelligence.—The slightest failure of the body-machine to operate effectively stirs the person thus troubled to action or investigation. Not often is there in evidence intelligent understanding of the organs or processes causing the deranged condition. The complex apparatus of modern life is mastered by many men and women who permit their bodies to remain mysteries to them.

It is true that scientific names, in Latin or otherwise, may seem to create an obstacle to some readers. This fact has been recognized throughout the pages of this work. Commonly understood names are used wherever this is possible.

In the instance of anatomy, it becomes necessary for readers to gain some degree of acquaintance with the names applied to the various structures of the body by anatomists. Otherwise those interested may be unable to follow professional books and instruction on this subject.

A far-reaching reason for the use of Latin and other names for bodily structures is the fact that anatomical names are thus standardized in all languages. Misunderstanding and serious complexities might otherwise result. Of all studies, health must perforce be international



This diagram shows the general position of the organs of the trunk, in relation to each other. The method by which veins and arteries maintain circulation of the blood is shown also.

in scope, and those who place discoveries at the service of the world must not be limited by the boundaries of language.

The study of anatomy and its companion-subject, physiology, is not a trying or difficult matter, but an interesting voyage of discovery. It is true also that when one lacks the advantage of instruction from the actual human model, illustrations serve the student just as maps serve the stay-at-home explorer, who must accomplish his voyages on the printed page.

Mind and Body.—The study of mind and body may well begin with consideration of the part of man's organism that marks him from other living creatures. His forebrain, or cerebrum, is master-organ of man's being, and in turn makes him master of earth. Its cortex, or covering, marked by innumerable crevices and folds, tells the story of the character or the capacity of its owner. One such fold may mark him as a cold-blooded assassin—another may be the symbol of forgiveness for his would-be murderer.

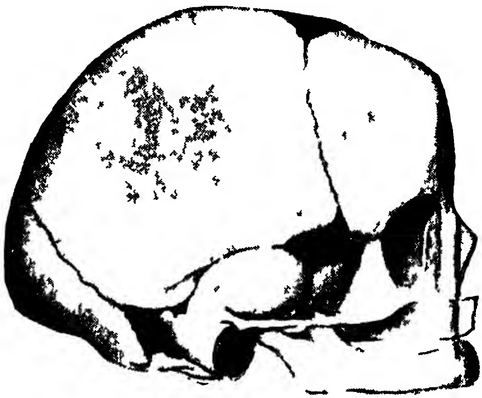
His brain, and its extensions, and the cerebellum, spinal cord and nerves, are the chief distinguishing features between man and other forms of animal life upon earth.

Man's physical structure begins to assume the aspect of a book of wonders when we attempt to study the thinking-machine in relation to its bodily chassis. For the operation of the human brain is quite as physical as that of organs lacking in thought-processes. The brain is composed of cells and tissues like other parts of the body, is nourished by the same blood, and is subject to physiological laws to the same degree, and to instincts to a perhaps greater degree.

This fact, long recognized in its general application, in late years has entered more and more into the deductions of modern psychology. It is taken into account in these pages in dealing with human impulses and reactions, involved in personality, in sex, in parenthood and other phases of life now acknowledged as directly related to health.

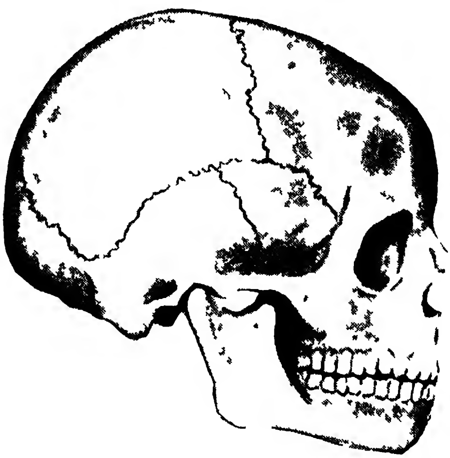
The exceptional length of the period of infancy and growth of the human being is a peculiar and significant fact, and one which to the casual observer may seem to be at variance with the superiority of humankind in other respects. Among all forms of animal life human offspring is the most helpless at the time that it comes into the world. It is more perfect than any other, even then, along the lines of its own human organization, but it is not as capable in any respect as the newly born of any of the lower animals; it is more dependent upon the parent for incessant care. We all know that the puppy of six months is a

very active and vigorous creature—indeed, not far from being physically as capable as he ever will be Some of the lower animals are able to walk about, or at least crawl, the very day they are born. With ourselves, however, it is different. At six months of age we can still do very little; certainly we cannot emulate the agility of the puppy At six months we are still learning the use of our muscles and our sense of balance but are not even able to walk as yet At two years of age the dog is at his best, but at two years the child is still only in the beginning of its development, when compared with the long period of growth, both mental and physical, which lies ahead of it. Maturity will not arrive for a score of years.



The incomplete development of the human skull at the time of birth is shown by this drawing. Sections of the bony structure have not united completely, and the unclosed fontanel at the top is in evidence

But why this exceptionally long period of growth and dependence upon the parents in the case of the human offspring? Might we have not supposed, with the superiority of our kind, that we should be able to outstrip any of our lower animal kindred right from birth?

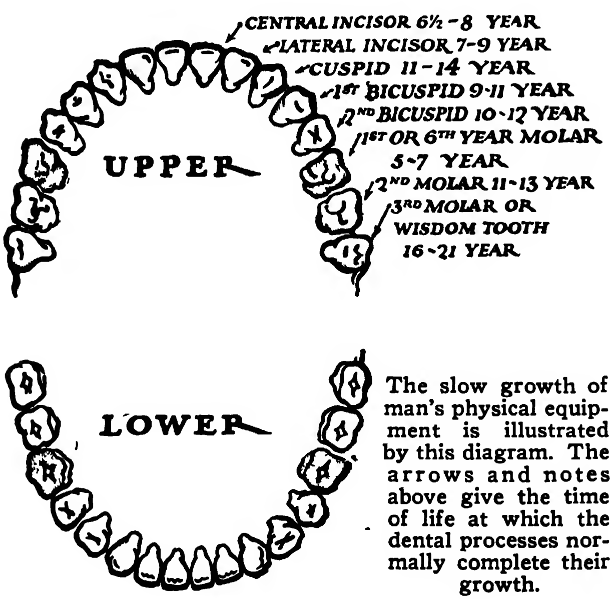


The development of the upper portions of the skull, as well as of the jawbone, is in evidence in this depiction of the adult human skull.

It is, in truth, this extended period of dependence and growth that makes possible the high attainments of mankind, whereas the rapid growth of our furred fellow creatures only marks their limitations when they have reached maturity.

The nerve organization of man is of a finer nature, for one thing, and this requires a longer time to develop. Furthermore, because of the extended period of the necessity of the supervision and care by the parent, not only is the child provided with greater possibilities for education and training, but from the standpoint of the parents there is formed the basis of that form of established family life which is one of the great factors of human progress. But the real reason is that which follows.

In the development of the human race, the more primitive instincts, or "race habits," of the lower forms of life have largely given way to the power of reason. Instead of these instincts being retained by us alongside of our intellectual developments, they have chiefly been displaced by the latter. Naturally, choosing between instinct and intellect, the latter is the higher gift. Some of our original instincts we still retain, and they serve us and protect us in many matters, but for the most part we depend upon the power of thought. The dog will sometimes turn around two or three times before lying down upon a smooth, soft rug, just as his wild and wolfish progenitor once did in order to make himself a comfortable bed when lying down to sleep in tall grass or deep snow; but we do not do such unintelligent things. We learn to use our minds in these matters and just here is the secret of our protracted infancy — *we have to learn* to use our minds and to reason. The animal finds himself in full possession of his instincts at his birth. But each individual human being is compelled to build up his own mental machinery, or



The slow growth of man's physical equipment is illustrated by this diagram. The arrows and notes above give the time of life at which the dental processes normally complete their growth.

rather to train it as he does his muscles, and this takes time. If, like many animals, we grew to maturity in a few years, we should be incapable of the high development of nerve tissue and mind that makes us what we are.

Our slow physical growth, corresponding with the development of the mind, is quite in line with the refinement of our tissue structures, their vitality and enduring quality. A creature of cruder structure might mature in a fraction of the time required for us. However, our prolonged period of growth is in accord with the usual rule among other animals that the period of physical growth varies with the varying life-spans of the different species, and according to which an animal that matures in twenty years possibly may live five times longer than that which reaches full size and strength in four years.

Not the least wonderful thing about the human body is its almost unlimited power of self-regulation, of recuperating its own wasted forces and of mending itself when it is injured. Like any complex machine, the body may suffer some disorder or injury as the result of exceptional strain or violence, but, unlike any ordinary machine, it repairs itself. If any part be broken, or torn, or cut (any part with the exception of the nerves), the body sets about in a most remarkable and systematic way to mend it, sending an exceptional supply of blood and new building material to the affected part. With the activities of each day we use up a good part of the available energy of the body and consume a greater or lesser amount of the bodily tissues (largely muscular); but even as this is done the organs and fluids of the body are at work rebuilding new tissue and energy. And at night, when the deficit of energy, the breaking down or consumption of cell tissue, and the accumulation of the waste matter so produced becomes sufficiently great to cause decided fatigue and inconvenience, then the work of repair is carried on in a far more rapid and effective manner through the revitalizing processes of sleep.

What the Body is Made of.—Before the forms or uses of the various portions of the body are studied, it is necessary to understand that the body as a whole is a compact mass of chemical compounds arranged according to a definite and unvarying scheme of Nature. Such compounds are very numerous, indeed, but all are made up of differing combinations of the chemical elements that are found in the human body. The elements are twelve and exist in readily measurable amounts. They are: Oxygen, hydrogen, nitrogen, carbon, calcium, phosphorus, potassium, chlorine, sodium, sulphur, magnesium, and

iron, and iodine. Some other elements are found in the body, though in very small quantities. They include fluorine, manganese, silicon and copper.

The combinations of these elements, as found in the body, are divided into two chemical groups—the organic and the inorganic compounds. The organic compounds are those that contain carbon as one of the elements. The inorganic compounds are those that do not contain carbon. Thus albumen, which is composed of nitrogen, hydrogen, carbon, oxygen, and sulphur is an organic substance. Calcium phosphate, which makes up nearly 60 per cent. of the human bone, is composed of calcium, oxygen and phosphorus; having no carbon, it is an inorganic compound. Broadly speaking, all of the substances that we are accustomed to regard as foods are made up of organic compounds. The carbon and hydrogen in them are burned in the body for the purpose of creating muscular energy and heat. These organic foods are divided into three classes, as follows:

(1) Nitrogen-containing foods, commonly called protein—Albumen, fibrin, casein, gluten and gelatine. Albumen is found in its purest state in the white of egg; fibrin is the substance in blood that causes its coagulation when exposed to the air; casein is the principal protein in milk and cheese, and gluten in wheat; while gelatine is obtained from the bones and the fibrous tissues of animals.

(2) Fats—Animal and vegetable oils. The fats of meat, butter, olive oil, etc., are good examples.

(3) The Carbohydrates—The starches, dextrin and sugars, of which there are many kinds.

Fats and carbohydrates contain no nitrogen and are therefore called non-nitrogenous foods.

Water, an inorganic substance, composed of the two elements, hydrogen and oxygen, is absolutely necessary to life, as it furnishes the solvent for carrying all of the food values in fluids. About 66 per cent. of the body is water.

Protoplasm is the vital substance of all animal and vegetable life cells. It changes according to the structure of the tissue. Simple protoplasm resembles the white of egg, being a clear, viscid fluid, one quarter heavier than water. Its composition is always complex, but varies, being subject to change or differentiation, and forms epithelium, muscle, glands, nervous structures, bone, etc. Protoplasm is found in these structures as the main portion of cells. These cells possess the powers of manifesting all phases of life shown by the body as a whole—

taking nourishment, elimination, reproduction, etc. In the human body the little mass of protoplasm possesses a nucleus, or central body, for which reason it is called nucleated protoplasm.

All of the tissues of the body, whether found in nerves, muscles, cartilage, bone, or skin, are made up of great numbers of cells in mass. The cell is the smallest mass in the body which has a definite form. A cell is made up of masses of nucleated protoplasm, which it resembles. Somewhere in the mass of the cell, usually near the center, is a central body that is called the nucleus of the cell. On the meshes of the nucleus may be found an enlargement known as the nucleolus. A nucleus may contain several of these nucleoli, or none at all. Often the protoplasm at the outer edge of the cell may exist in such state as to form a cell wall, or cell-membrane.

Metabolism, In Inactivity (Basal) and Activity.—Cells constantly are being replaced by new cells. Food is taken into the body in order that it may be converted into the nourishing fluids that are carried through the system to repair cells or to build new ones. Protoplasm takes up this nutrient matter, and water is needed as the solvent to make these nourishing substances into fluids. Exercise is destructive of such of the cells as are all but worn out. Oxygen that comes into the blood in the lungs burns out this waste, dying matter. The blood and other fluids of the body carry away this burned-out matter, to be cast out by the excreting and depurating organs.

Exercise not only helps to destroy the nearly worn-out cells throughout the exercised portions of the body, but it quickens the respiration through the demand for more oxygen with which to burn up the waste and dead matter. Much of the carbon brought away in the blood returning from the tissues to the lungs is consumed in the lungs, and is exhaled in the form of carbonic acid gas. Some of the waste is exuded from the pores of the skin in the form of perspiration, and bathing is resorted to in order to carry this waste away from the skin and to prevent the pores from becoming clogged up and thus sources of ill health.

If it were not that Nature has ordained that a time must come when decay will take place in the body more rapidly than repair can offset the destruction, it would be possible, generally speaking, for man to make himself immortal in this world through the right amount and kinds of exercise, proper breathing of pure air, sensible diet, the proper use of water inside and out and the right amounts and kinds of rest and clothing. As it is, by these aids man is so well able to prolong

his life to a healthy and advanced old age that it may well be said in most cases that health is optional.

As we have seen, the cell is the elementary structure, but a collection of these cells, united in such a way as to form a whole, is spoken of as a tissue. In using the word "tissue," we often think of materials more or less interwoven, but in the human body it may mean simply a collection of cells placed side by side and cohering together in whatsoever manner.

The tissues of the human body may be classified into five different kinds, namely: (1) Epithelial tissue; (2) Connective tissue; (3) Muscle tissue; (4) Nerve tissue; and (5) Blood and Lymph. All of these different kinds of tissue involve a different character and arrangement of cells.

1. *Epithelial tissue* consists of cells placed very closely in contact, with very little cement substance interposed, and is found chiefly in three forms, (a) pavement epithelium, in which the cells form a plate-like substance, either thick or thin; (b) cylindrical epithelium, the form being indicated by its name; and (c) ciliated epithelium, upright cells provided with the most minute hairs for certain purposes.

Pavement epithelium may be found in several layers, an example of its structure being found on the surface of the human body. Cylindrical epithelium lines the interior of the stomach, intestines and many other of the cavities of the body, while ciliated epithelium lines the inner surface of the greater part of the respiratory tract. In every case the epithelial layer serves as a protection for the tissues lying underneath, the latter being subject to injury whenever there is a break in the former. The epithelial cells are also to be found in the true glands of the body, lining all ducts and tubes.

Indeed, the most primitive or simple type of gland is a mere tube, lined with epithelial cells. The secretion formed by the gland empties upon the epithelial surface, whereupon it finds its exit from the tube. *A gland,* we may say here, is an organ which secretes, that is, produces certain substances necessary for the proper functions and activities of the body. According to the nature of these secretions the glands are called salivary glands, gastric glands, mucous glands, sudoriferous or sweat-glands, sebaceous glands, the liver, pancreas, etc. Other important glands that produce internal secretions are the pituitary, pineal, thymus, and thyroid, the adrenals, spleen, and the gonads (testes in the male, ovaries in the female). These glands yield internal secretions of great importance.

It happens in many cases that a number of little tubes unite to form a larger gland, the openings from these various tubes discharging their excretions into a common duct or outlet channel. This would be called a compound gland; the interior space, both of the tubes and the main duct, if filled in, would perhaps take the form of a microscopic tree. A gland of material size, like the larger ones that will be described later, consists of many of these ducts, uniting to form a large common duct into which all the secretions are emptied, like the tributaries of a stream. All these ducts of the glands, and their tiny tributaries, are lined with the epithelial cells. The lymph glands, to which reference will be made later, do not secrete in the true sense, are not supplied with excretory ducts, and are not to be confused with the true glands.

(2) The term *connective tissue* includes several tissues of the human body, whether they support parts of the body or imbed various organs. There are four chief classifications: (a) Connective tissue proper; (b) Fatty tissue; (c) Cartilage; and (d) Bone.

(*a*) Connective tissue proper consists of cells embedded in a comparatively large amount of ground-substance, which has a remarkably fibrous structure. These fibers are generally arranged in bundles or bands, in two varieties—loose and firm connective tissue.

Loose connective tissue is more elastic and more easily displaced, its separate fibers or bundles being arranged in wider meshes, like a mass of loose woolen thread. It is to be found where certain organs are close to each other but yet are movable. A certain amount is placed between the different muscles so that they may contract and move without friction. Loose connective tissue is found underneath the skin, and in greater quantities in those parts where the skin can be picked up in folds. If we could maintain this connective tissue in more perfect condition with advancing years we might avoid much of the appearance of age, as in the face, for instance. Vigorous health and an active circulation, therefore, are very efficacious in this direction. Loose connective tissue forms a light gray mass, and may be seen in the meat of animals, separating or lying between the red masses of muscle.

Firm connective tissue consists of similar fibers or bundles placed very closely together or interwoven. This will be noted later in connection with the tendons which attach the muscles to the bones, for these tendons are good examples of firm connective tissue, as are also the ligaments which reenforce the bony framework and hold it

together. The important membranes of the body, chiefly protective agencies, are also composed of connective tissue, more or less firm, in which the fibers usually run in all directions.

The fibrous matter of connective tissue consists of gelatine. When boiled in water it dissolves finally to a jelly-like mass, which, on cooling, forms a thick, firm jelly. Those who cook and eat meat are familiar with it. Much of the glue of commerce is manufactured from the hoofs and horns of cattle, and other parts rich in connective tissue.

(*b*) Fatty tissue is a form of connective tissue in the cells in which large amounts of fat have been distributed, so that the cells are round like balls. Normally, a certain amount of it is valuable as a reserve deposit of nourishment. Among wild animals who hibernate or for other reasons are sometimes deprived of food for a time, the storing up of fat is a helpful provision. Not only is fat useful to produce heat in the body in winter, but it is a poor conductor, and prevents the internal organs from having their heat too rapidly dissipated when the body is exposed to chilling air. At the same time, the fat person will suffer most in summer, since the heat of his own body can less easily find an outlet.

Fatty tissue, furthermore, acts as a cushion and support for delicate organs, which without this protection might be frequently injured. The eye proper lies in a soft cushion of fatty tissue, and the kidneys are likewise embedded in layers of it. So we see that this form of tissue is really indispensable, although excess of it is to be avoided.

(*c*) Cartilage also consists of a certain proportion of cells, but embedded in a firm, translucent ground-substance, which, while giving firmness, also possesses a certain degree of flexibility and ductility. It has a bluish-transparent shimmer, looking something like porcelain. A good example of cartilage is the end of the nose. The bone of the nose comes about half way down the bridge, and the tip, somewhat flexible, is given its character by a formation of cartilage. You can feel how firm it is, and yet how ductile. It will not break readily, as will bone, under strain of violence. It is found throughout the body wherever a certain amount of support is required without loss of this ductility. The front ends of the ribs are of cartilage, to permit of the movements of the ribs in breathing. There is usually much cartilage, also, about the joints, to reenforce them and to provide against friction. Later will be noted the indispensable character and use of cartilage in the wonderful structure of the spine, in which nothing else could provide the same cushion-like

quality combined with strength and support. In some cases many elastic fibers are embedded in the ground-substance, as in the cartilage of the ear, making it unusually elastic.

(*d*) Bone, in spite of its hardness, is only a form of connective tissue, consisting of cells which lie in a ground-substance composed very largely of phosphate and carbonate of lime.

The other tissues of the body, (3) Muscle tissue, (4) Nerve tissue, and (5) Blood and Lymph, will be considered in pages to follow, dealing especially with them. If it should seem strange to classify blood and lymph among the tissues of the body, in spite of their fluid character, then it may be said that they consist of cells suspended in a fluid ground-substance and may properly be included in this classification.

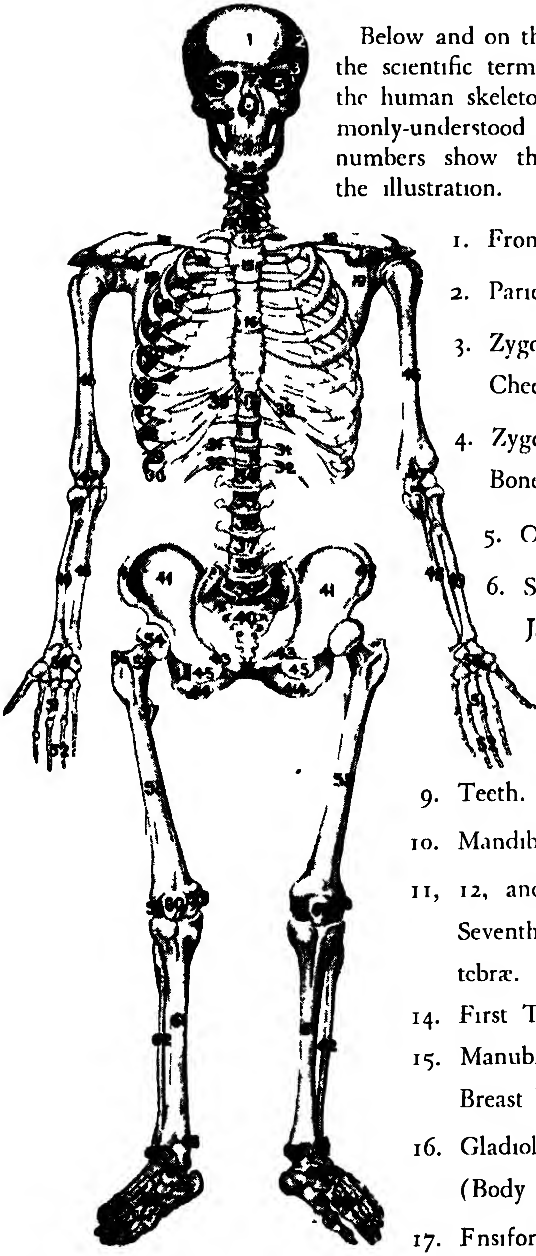
In the succeeding pages no attempt will be made to consider exhaustively the minute details of every nook and corner of the body, for that would require many a vast library. A clear, general understanding of the make-up of the body and a practical working knowledge of its functions, however, will be given.

The Body's Framework.—What the steel framework is to the modern "skyscraper" building, the skeleton is to the human body, only much more. The steel structure of a thirty-story building is rigid and immovable, designed only to support the weight of the whole, but the skeleton, while giving stability and support to every part of the human body, and protection to the most vital parts, is at the same time so wonderfully devised as to permit of every possible movement.

We all of us know, or will realize, that the bones grow in the earlier years of life. It is apparent at once that the child's bones must increase in size. The bones of the body undergo just as incessant change, at all times in life, as do the fleshy or muscular tissues or the nerves. Bones are made up of cells, just as flesh is, and these cells are constantly going through the same processes of birth, growth, decay and death as do the fleshy cells. Cells of the bones may be increased in size, number and in health just as are the other cells of the body. The only difference is that the cells that make up the bony structure go through their processes more slowly than do the cells in the fleshy parts.

As already has been seen, bone tissue is a form of connective tissue, its cells being embedded in a ground-substance of extreme hardness because of the large percentage of phosphate of lime and carbonate of lime. The cells themselves are star-shaped, with many little projections.

BONES OF THE HUMAN BODY



Below and on the following page appear the scientific terms used for the bones of the human skeleton, as well as more commonly-understood names for them. Key numbers show the location of bones in the illustration.

1. Frontal Bone (Forehead).
2. Parietal Bone (Side of Head).
3. Zygomatic Process (Arch of Cheek Bone).
4. Zygomatic Bone (Cheek Bone).
5. Orbital (Eye) Cavity.
6. Superior Maxilla (Upper Jaw).
7. Nasal Bone.
8. Nasal Cavity.
9. Teeth.
10. Mandible (Lower Jaw)

11, 12, and 13. Fifth, Sixth and Seventh Cervical or Neck Vertebræ.

14. First Thoracic Vertebra.
15. Manubrium Sterni (Top of Breast Bone).
16. Gladiolus or Corpus Sterni (Body of Breast Bone).
17. Ensiform Appendix (Lowest Point of Breast Bone).

18. Clavicle (Collar Bone).
19. Scapula (Shoulder Blade).
20. Coracoid Process (Crow-bill Process) of Shoulder Blade.
21-27. Costa Veræ (First True Rib to Seventh True Rib).
28, 29 and 30. Costa Spuriæ (Eighth, Ninth and Tenth False Ribs).
31 and 32. Costa Spuriæ (Eleventh and Twelfth False or Floating (Ribs).
33. Cartilago Costalis (Costal Cartilage).
34. Twelfth Thoracic Vertebra.
35 to 39. First, Second, Third, Fourth and Fifth Lumbar Verterbræ.
40. Os Sacrum (Cross Bone).
41. Ilium (Hip Bone).
42. Iliac Crest (Hip Bone Crest).
43. Os Pubis (Pubic Bone).
44. Ischium (Seat Bone).
45. Foramen Ovule (Oval Opening of Pelvic Bones).
46. Humerus (Upper Arm Bone).
47. Condyle (Knuckle of Upper Arm Bone).
48. Ulna (Inner Bone of Forearm).
49. Radius (Long Prismatic Bone of Forearm).
50. Carpal Bones (Wrist Bones).
51. Metacarpal Bones (Bones between Fingers and Hand).
52. Phalanges (Bones of the Finger).
53. Femur (Thigh).
54. Caput Femoris (Head of Thigh Bone).
55. Collum Femoris (Neck of Thigh Bone).
56. Great Trochanter (Large Rotator).
57. Lesser Trochanter (Small Rotator).
58. Outer Condyle (Thigh Protuberance).
59. Inner Condyle (Thigh Protuberance).
60. Patella (Kneecap).
61. Tibia (Shin Bone).
62. Fibula (Splint Bone).
63. Internal or Inner Malleolus (Inner Foot Bone).
64. External or Outer Malleolus (Outer Foot Bone).
65. Tarsal Bones (Ankle Bones).
66. Metatarsal Bones (Middle Bones of the Foot).
67. Phalanges (Bones of the Toes).

Not unlike the legs of a many-legged bug, these projections serve to connect each cell with its neighbors.

In the adult, the bones are made up two-thirds of this mineral matter, and perhaps one-third of animal matter, chiefly the gelatine, which is characteristic of all the fibrous matter in the various connective tissues. The bones of babies are nearly all of gelatine, or, in other words, they are largely cartilaginous, being therefore so pliable that they do not break easily. As they grow older the percentage of mineral matter is increased, but throughout all childhood the bones continue to be sufficiently pliable to avoid breaking easily. As age approaches the gelatine gives way almost entirely to the mineral matter, causing the bones to become extremely brittle. The more active one's habits, the better his health and circulation, the more perfect will be the condition of his bones to the very last. Stagnant habits and poor health will hasten the characteristics of age.

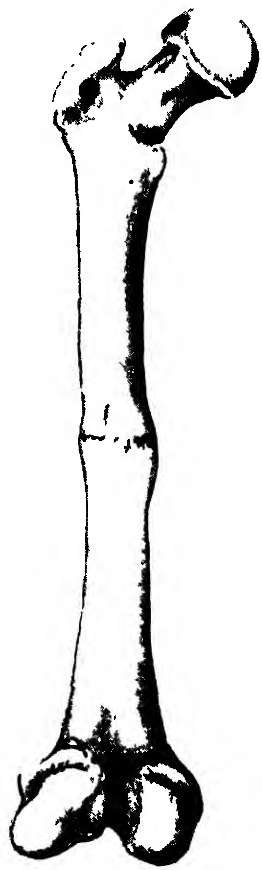
The living bone is covered with a delicate yet extremely tough membrane known as the periosteum. This membrane is intricately equipped with blood vessels that nourish the bone. Another function of the periosteum is to protect the bone as much as possible from shocks and jars. Let a portion of the periosteum be injured, and the bone contiguous to the injury will suffer disease and decay. So wonderfully vital to the processes of the bone is the periosteum that where pieces of the bone have been removed without injury to the periosteum the bony tissue has been known to grow again to full health—a secret of Nature's of which surgeons have taken advantage in the performance of some seemingly wonderful operations on bones.

Yet not by any means all of the nourishment of the bone comes through the periosteum. Any long bone, if cut so that the cross section may be examined, reveals the fact that the hard, ivory-like substance with which we are all familiar does not extend throughout the thickness of the bone. Inside of the hard outer shell is a softer substance called the cancellous tissue. This is sponge-like, somewhat hard near the shell, and becoming by gradual transition softer and softer as we go toward the center of the bone. This inner, softer part of the bone forms what is known as the medullary canal, the canal being employed to carry nourishment to every portion of the bone in conjunction with the work of the periosteum. This canal is filled with a yellow, fat-like pulp to which is given the name of marrow, and which is thickly supplied with blood vessels. The whole interior of the bone is a complicated system of canals; in many of the bones

is found an especially large canal known as the nutrient foramen, and this protects the main artery that carries nourishment throughout the structure, branching off into more and more minute arteries.

In the flat bones, on the other hand, we find two thin plates of the harder material, with the spongy or cancellous tissue between them. The short and irregular bones have the cancellous tissue, but there is no medullary canal. When a thin section of bone is seen under the microscope a great many openings are detected in the cancellous tissue. These are the openings of channels that are called the Haversian canals, after their discoverer. These run the length of the bone, and contain myriads of the minutest blood vessels. All around these canals is a thick network of tiny cavities known as the lacunæ, which contain bone-cells, while wonderfully small canals—infinitely smaller than hairs—connect the Haversian canals with the lacunæ.

Two specimens of the femur, the long bone of the upper leg. The left specimen shows a united fracture, the callous formation at the middle indicating the location. The right specimen shows an unusual form of fracture at the middle of the shaft.



There is no medullary canal at the end of a long bone; it ends in cancellous (spongy) tissue with a very thin shell.

It is a curious fact that there are more bones in the infant's body than in that of the adult. Thus, there are twenty-two bones in the skull of a man of thirty; in the infant there are more, in order to permit of the growth of the skull and of the brain that it encloses. As adult age is neared some of the separate bones knit together. By the time old age is reached this process has gone even further, and there are fewer than twenty-two bones in the skull. The same peculiarity is noted in the sacrum and the coccyx at the base of the spine, and at some other points in the body. There are, in all, two hundred and four distinct bones proper in the frame of the adult.

Besides the various large and small openings in the bones by which the blood vessels and nerves penetrate and leave them, there are numerous projections and irregularities on the surface by means of which the various muscles are more securely attached.

The skull is the name of the group of bones contained in the head, these serving not merely for support, but, what is even more important in the case of the brain, as a means of protection. The skull may be divided into two sections, the *cranium* and the *face.*

The arched or upper part of the skull is known as the *vault,* whereas the lower portion is called the *base* of the skull, being irregular, and provided with many projections and openings.

The front of the vault is made up by the frontal bone; back of this, side by side, and forming the large middle of the vault are the two parietal bones; and behind, forming also the posterior portion of the base, is the occipital bone. Here, in the base of the skull, is found a large round opening (the foramen magnum) through which the spinal cord passes into the brain. On each side of the skull are the temporal bones, forming chiefly the lateral walls, and on the lower sides of which are the openings leading to the mechanism of the ears. Behind these, and pointing downward, is an important projection known as the *mastoid process,* to which is attached the strongest muscle of the neck, the *sternocleidomastoid.* This mastoid process also contains a number of cavities which communicate with the middle ear. There is serious trouble when inflammation of the ear spreads to these cavities.

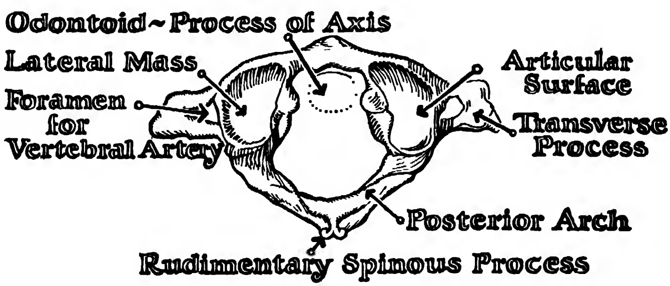
The *zygomatic bones,* usually known as the cheek bones, are found below and at the side of the orbits. They are connected with the temporal bones by means of a narrow arch of bone, the *zygomatic arch,*

the horizontal ridge of bone which can be felt with the fingers just under the temples. The two nasal bones give shape to the upper part of the nose, that of the lower part being determined by cartilage. Beneath the zygomatic and nasal bones is the large upper jaw, constituting the greater part of the framework of the face, and containing the upper teeth. This upper jaw really consists of two bones known as the *superior maxillae,* entering into the formation of the walls of the cavities of the nose, mouth and orbit. They, of course, have small foramina for the transmission of the nerves of the teeth and nutritive arteries.

The lower jaw, or *mandible,* the only movable bone in the head, consists of two bones at birth, which unite at the chin into a single bone during the first year of life. It forms the lower part of the face, and consists of a horseshoe-shaped body from the ends of which two branches extend upward, these latter branches possessing articular processes which connect with the temporal bones by means of the *temporo-maxillary joint.* This is the "hinge" upon which the jaw works when we open and close the mouth.

The orbital cavities for the eyes are very pronounced, but for general purposes it is not necessary to know in detail all of the small accessory bones. Between the orbital cavities is the nasal cavity, divided by a partition into two sections, known as the left and right nasal fossa. From the lateral walls of these project three shell-like processes, the so-called turbinate bones of the nose. The floor of the nasal cavity is formed by the hard palate, this also forming the fore part of the roof of the mouth.

Beginning with the trunk, first should be taken the bones of the *spine,* or "back-bone." It is impossible to conceive of a more wonder-



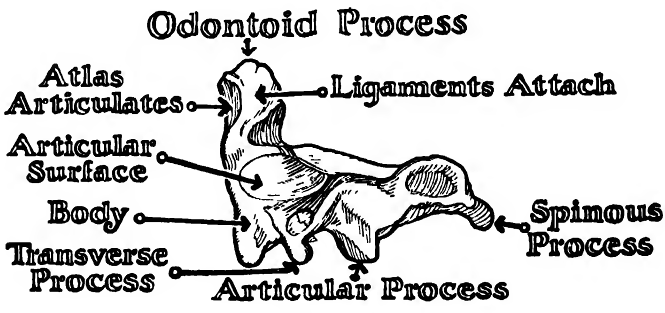
This drawing, in reduced scale, shows the atlas, or first cervical vertebra. The articular processes are shown to right and left. These are the means by which the atlas maintains direct contact with the base of the skull.

ful bit of machinery, since, in one way and another, it dominates all the functions of the body, and all other portions of the skeleton are made subservient to it. This spinal column is made of separate bones; there are seven that belong to the neck, and are known as cervical vertebræ; below are twelve vertebræ that belong to the back and support the ribs, and these are known as dorsal or thoracic vertebræ; the five lowest vertebræ, belonging to the loins, are known as the lumbar vertebræ.

It is most important that the student should thoroughly learn and remember the names and locations of these various groups of vertebræ, with their numbers, because of the importance of locating thereby the various spinal nerve centers later, in the study of the nervous system. It is more important to have a knowledge of the bones of the spine than of any other part of the human skeleton.

While the bones of the spinal column differ slightly in shape, according to location, the general structure of one vertebra is like that of another. Upon the atlas, or uppermost of the cervical vertebræ, the head rests. A central cavity, a *foramen*, is found in the atlas, and this foramen is repeated in each of the vertebræ, thus forming a canal through which the spinal cord passes. This spinal cord is the master nerve of the body, controlling the entire nervous system. Between each two adjoining bones are openings through which branch nerves pass out to all portions of the body.

Between each pair of vertebræ is a cushion of cartilage. These hold the spine together, soften jars, prevent friction of the bones,



Here appears a reduced reproduction of the axis, or second cervical vertebra. The odontoid process at the top articulates with the arch of the atlas, or first cervical vertebra, to form a pivot joint as a support for the head. Below, the axis is attached to the third cervical vertebra by ligaments.

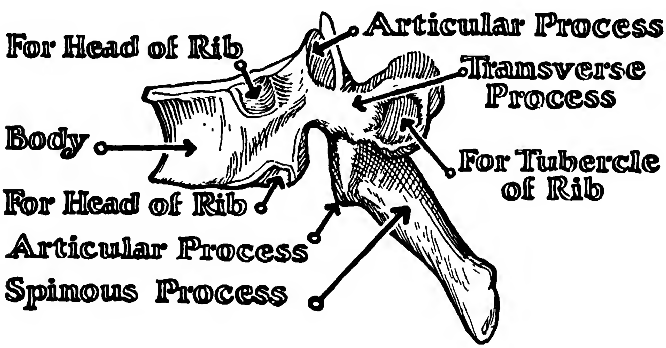
and give the needed elasticity to the spine. Cartilage thus performs here the same service that it does in other portions of the body.

At the lower extremity of the spinal column is a most important but little-heard-of bone, known as the sacrum, or sacred bone. It is a three-sided, wedge-shaped affair that gives some support to the spinal column. It is wedged between the hip-bones in such a manner that it will be seen to form the keystone of the pelvis. The sacrum articulates below with a small bone known under the name of coccyx.

When the head moves forward or backward, it moves on the second cervical vertebræ, or axis, and the ligaments prevent it from moving too far. When the head is turned from side to side the skull and atlas pivot on a bony peg on the top of the axis or second cervical vertebræ, and here again ligaments prevent the head from making a complete turn around.

Beginning at the base of the neck in front, the sternum or breast-bone runs downward. This bone has a most important function, supporting the ribs, as it does, in the front of the body. From the necessities of its office the sternum is tough and elastic at the same time. It is rarely fractured by a blow in the breast, having as it does great resistant power and great power to bend before a blow. When a fracture of the sternum does occur it is a serious matter.

The seven uppermost ribs are known as the "true ribs," since they

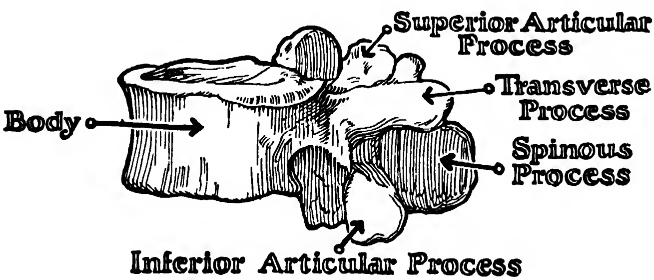


This somewhat reduced drawing of a typical thoracic, or dorsal vertebra, shows the points where it articulates with the superior and inferior vertebræ and with the corresponding rib. The spinous processes of the vertebræ form the bony knobs down the center of the back from the neck to the hips. The spinal cord passes through a canal formed by the arches of the vertebræ, and the spinal nerves emerge from between each vertebræ at the lower notch between the body of the vertebra and the transverse process.

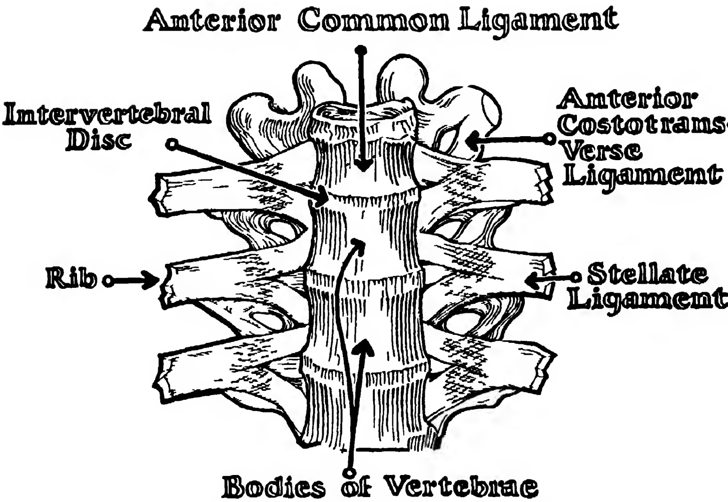
all connect directly, on both sides of the body, with the sternum. The next three ribs, on either side, are known as "false ribs"; they do not touch the sternum, but are connected with it through other ribs, and by cartilaginous connections. The lower two ribs on either side are called "floating ribs," for the reason that their forward ends are not in any way associated with the sternum. All of the ribs proceed from the dorsal vertebræ.

Considering the importance of the hip-bones in the skeleton structure of the body, it may seem odd that anatomists have given to them the name "ossa innominata," which means "unnamed bones." Much more expressive was the old Anglo-Saxon name, "haunch bones." The shape of these bones is oddly irregular; at first glance their appearance conveys an idea of awkwardness. But the bones are ideally shaped for the work that they have to perform. On the inside edges these two bones are joined firmly together, but the sacrum is wedged into place between them. The hip-bones, sacrum and coccyx form the framework of the pelvis, or pelvic basin, of the trunk. It will be noted that there are no bones in the front or anterior portion of the lower trunk, the abdomen being without a framework protection, since it needs none. This arrangement allows of a natural expanding and contraction of the abdomen by deep breathing, and provides a flexible portion of the trunk for body bending and rotation. This portion is covered with heavy muscles, whose fibers run in various directions, forming a natural corset. It expands by food excess; hence this corset may become weak.

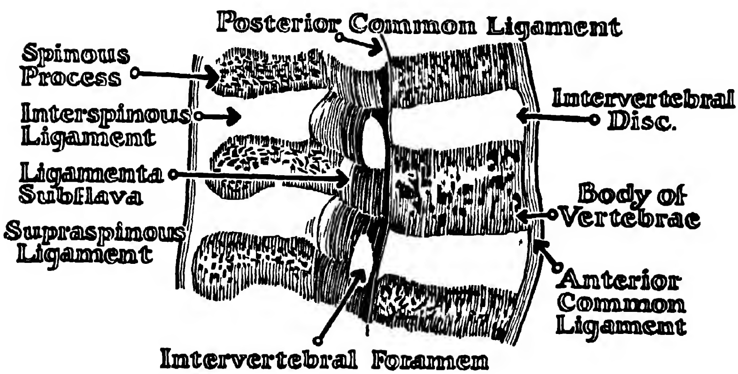
There is a notable distinction between the male and female pelvis, suited to the bodily requirements of each. The female pelvis, suited



A typical lumbar vertebra somewhat less than life-sized. The support of most of the weight of the trunk falls upon the lumbar vertebræ, which are of greater bulk and of more rugged construction than any others. The spinous processes of these vertebræ have no shafts.



A sectional representation in reduced scale of the dorsal region of the spine, viewed from the front. A few of the numerous ligaments in the dorsal region are here shown. Note the close binding of the vertebræ to each other and to the ribs



A longitudinal section of the spine. The drawing shows a dorsal vertebra with parts of the vertebræ immediately below and above it. The intervertebral discs form cushions between the bodies of the vertebræ, while they are knit closely by longitudinal ligaments and by ligaments between the spinous processes.

to the requirements of maternity, is considerably broader and not so high, whereas that of the male, perhaps designed for the greatest possibilities in the way of strength, is higher and more narrow.

On the outer edge of each os innominatum is a cup-like socket, into which fits the rounded head of the femur, or thigh-bone, the long and solitary bone of the upper half of the leg. The articulations of the joints of the arms and legs, and the part played by the shoulder-blade and the clavicle, or collar-bone, will be explained later.

Breaks or fractures are common accidents to bones, and require prompt surgical attention if the bone is to be restored to something like its former strength. When a bone is broken in a single place the result is a simple fracture; it is a comminuted fracture when the bone is broken in two or more places. Occasionally a bone is broken in such fashion that a splintered end punctures the periosteum, the soft flesh and the skin. This is known as a compound fracture; it is always serious and calls for surgical skill.

In the appearance of the structure of the shoulder-blade there is much of similarity with the hip-bone; and, indeed, the shoulder-blade performs a similar office in providing a hinge from which a limb may hang and act.

The shoulder-blade, or *scapula,* as anatomists term it, is triangular in form. It forms the back portion of the shoulder girdle, which is composed of the scapula and of the clavicle, or collar-bone.

The scapula begins at about the level of the first dorsal or thoracic vertebra, and extends down about to the level of the seventh dorsal vertebra. In some skeletons the scapula is found to extend as low as the eighth dorsal vertebra. The inner edge of the scapula is close to the spinal column, and runs nearly parallel to it, being at a greater distance from the column at the lower end than at the upper. To a great extent the scapula is held in place by the muscles, ligaments and cartilages that bind it. The clavicle, or collar-bone, has also much to do with keeping the scapula in place.

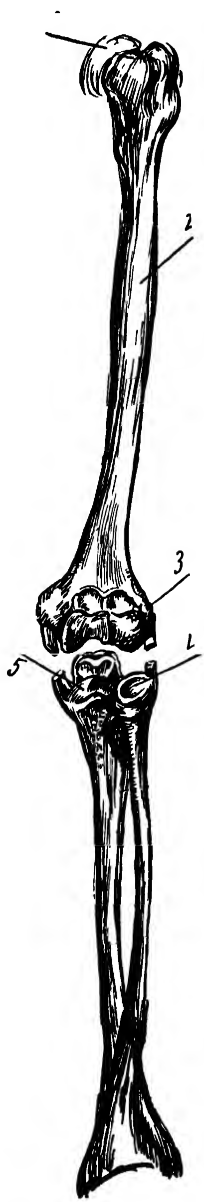
Along the back or posterior surface of the upper portion of the scapula runs a ridge of bone that is known as the scapular spine. This spine terminates in a winding, irregular bone that projects out beyond the scapula proper, and this projecting bone is known as the acromion process. It forms the posterior guard to the glenoid cavity. Running from the anterior side of the upper scapula, and somewhat in line with the acromion process, is the coracoid process, a projection of bone which forms the anterior or front guard of the glenoid cavity.

The glenoid cavity itself is a shallow, cup-like hollow at the upper, outer end of the scapular triangle. Into this hollow fits with great nicety the smoothly-rounded head of the humerus, or bone of the upper arm. This provides a fair ball-and-socket joint, which renders possible the great freedom of movement of the arm from the shoulder.

But there is yet one more essential in this shoulder movement, and it is to meet this necessity that the clavicle exists. The clavicle articulates with the manubrium, or head of the sternum (breast-bone), being attached to a depression at the side of the manubrium. The clavicle, long, slender and bending, extends out past the scapula, attaching to the upper edge of the acromion process. Thus the clavicle helps to hold the scapula, and incidentally the arm, in place. The clavicle prevents the scapula from moving too far backward, and, at the same time, keeps the shoulders from coming too close together, thus forcing the arms well out and giving them greater liberty of movement and execution.

In the shoulder we have found the ball-and-socket joint, but at the elbow we have still another kind, known as the hinge joint, so called from the fact that it allows forward and backward movements.

The heads of the ulna and of the radius furnish sockets into which projections from the base of the humerus fit, forming the perfect hinge that Nature designed. The ulna is the larger bone of the forearm. It is aided by the radius, which is the shorter bone on the same side of the arm as the thumb. The radius is so called because it is articulated with the wrist-bones and permits the radiation, or turning, of the wrist.



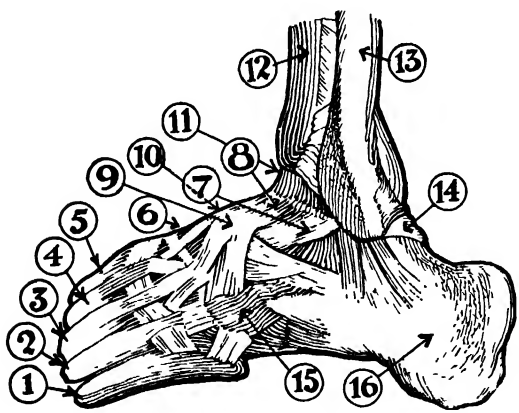
In this drawing of the bones of the arms, the upper bone is the humerus, the larger bone of the lower arm is the ulna and the other the radius.

1. Head of humerus **3. Condyle of humerus**
2. Shaft of humerus **4. Head of radius**
5. Head of ulna

When we come to the skeleton of the hand we find it to be divided into three groups of bones. These are: (1) The carpus, or wrist; (2) the metacarpus, or bones of the palm; (3) the phalanges or fingers. There are twenty-seven separate bones in the hand; of these eight are carpal, five are metacarpal; and there are fourteen phalanges—three in each of the fingers and two in the thumb.

It will be noted that the eight carpal bones, all of them very irregular, form in two rows, which fact gives greater flexibility to the wrist. These bones are bound by closely interwoven ligaments, but still there is greater flexibility, and the division of the wrist-bones into two rows renders the wrist less liable to fracture.

The metacarpal bones—those of the back of the hand—are attached at one end to the carpal bones, and at the other end to the fingers or thumbs. It will be observed, by experiment, that the metacarpal bones connecting with the fingers have but little freedom of movement, but that the metacarpal bone between the carpus and the thumb is capable of several distinct movements. Observation of a little varied work with the hand will show why this must be so. The greatest freedom of the phalanges is directed to various forms of grasping, although other movements of the fingers are employed in the use of the hand.



Ligaments and bones of the outer side of the left foot:

1, 2, 3, 4 and 5. First to Fifth Metatarsal Bones
6. Tarsometatarsal Articulations
7. Anterior Fascia
8. Talus
9. Navicular Bone
10. Tarsal Articulations
11. Ankle Joint
12. Tibia
13. Fibula
14. Posterior Fascia
15. Cuboid
16. Calcaneus

Reference has already been made to the ball-and-socket joint of the head of the femur, or thigh-bone, and the cavity in the hip-bone. The joints at shoulder and hip are very similar; here at the knee there is a hinge joint that is rather like that of the elbow. At the base of the femur are two well-polished protuberances, known as condyles, separated by a groove, that form a

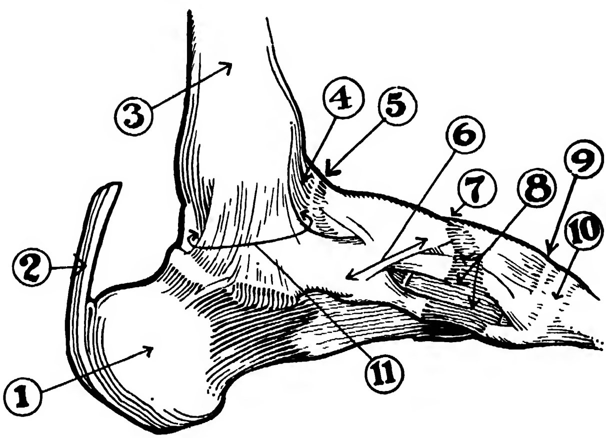
hinge joint with the knee cap and with the two bones of the lower leg, these two bones being known as the tibia and fibula. The tibia is known to everyone under the name of "shin-bone." It is a long three-sided shaft, and much larger than the fibula, which latter bone is firmly attached to the tibia at both ends. The lower extremity of the tibia forms the inside projection of the ankle-bone; the lower extremity of the fibula forms the outer projection of the ankle-bone.

The tarsal bones make up the ankle. These bones are seven in number. The rearmost of these bones, the calcaneus, forms the heel. The powerful tendon of Achilles, the strongest tendon in the body, which may be felt just below the calf, runs down to this heel bone, and is greatly used in keeping the foot in exact position.

Next to the calcaneus is found the talus, the bone that articulates with the tibia, forming a hinge joint. This bone bears the weight of the body on the foot.

Of the metatarsal bones it need only be said that they are five in number, and very similar in structure and functions to the metacarpal bones of the hand. The phalanges of the foot correspond rather closely to those of the hand, and are the same in number. The phalanges of the great toe are two in number, as in the case of the thumb.

At the knee the purpose of the patella, or knee cap, which is a small irregular disk of bone, is to protect the joint and to give greater leverage to the more important muscles there.

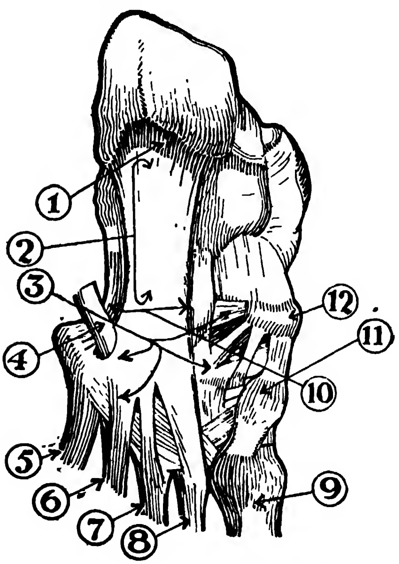


Ligaments of the inner side of the left ankle joint:

1. **Calcaneus.**
2. **Tendo calcaneus.**
3. **Tibia.**
4. **Anterior ligament.**
5. **Talus bone.**
6. **Navicular bone.**
7. **Articulations of tarsal bones.**
8. **Internal cuneiform.**
9. **Articulations of tarso-metatarsal bones.**
10. **First metatarsal.**
11. **Lateral ligament.**

At the joint

ends of bones are found thin layers of cartilage, which make the joints fast. Sockets have a deep ring of cartilage at the outer edge for the purpose of making the socket deeper. To hold the bone in place, and to give them greater security, ligaments pass over the joints, connecting the two bones with tough, elastic fibers that give the bones sufficient freedom and yet hold them strictly to their places and tasks. Ligaments do not break, as bones do, but they may be torn—lacerated—and it is, of course, possible to carry the laceration of a ligament so far that the last remaining fibers will snap if strain is put upon them. Lacerated ligaments of the knee may result from wrestling, and, in general, any severe wrench may result in the painful laceration of ligaments. A very thin tissue, known as synovial membrane, is found covering the concave surfaces of the sockets of joints. This membrane secretes and gives out at need a joint-oil known as synovia. It resembles the white of egg in appearance. By oiling the joints the synovia defeats the friction that otherwise would wear out the joints. Bursae or synovial sacks, are also found at the joints.



This diagram shows the ligaments of the under surface of the right foot.

1. Calcaneus
2. Long Calcaneo-Cuboid Ligament
3. Plantar Ligament
4. Tendon of Peroneus Longus Muscle
5, 6 7, 8 and 9. Fifth to First Metatarsal Bones respectively
10. Cuboid Bone
11. Internal Cuneiform Bone
12. Navicular Bone

The question may arise in the mind of the reader as to whether or not the bones may be enlarged and developed as the muscles may be. We may say briefly that this is possible, but in most cases not likely. Naturally, the size and strength of the bones may be influenced chiefly by the habits and exercises of the individual during the years of growth, but after reaching maturity little increase in size can be expected. If one's physical development has been neglected during the years of growth, then a proper course of training taken up after maturity will tend to bring about a normal condition of every part, the bones included, and the latter may be

increased somewhat in size even if they cannot develop the greatest strength which might have been possible had the boyhood and youth been more favorable.

The more perfect and pure the condition of the blood, the greater the vitality; and the more active the circulation, the more satisfactorily will the bones be nourished, and under such conditions of good health they will improve if they have been below par in size and strength before the inception of the good habits which have brought about this good health. If they were already fully developed, then no change in size will be apparent, although they may be improved in quality and strength. A vigorous muscular condition is invariably accompanied with the active circulation that helps to keep all other tissues at their best. Laying aside all comparisons of muscular development, the bones of the athlete are stronger than those of the sedentary worker; his nerves are less susceptible to shock; his tendons are tougher and his ligaments less easily torn. Men who play football develop such hardihood that not only can they endure with impunity what might seriously injure the average man of business, but when they are injured they do not require so much time in which to mend. Their bones knit more rapidly, wrenched tendons and lacerated ligaments recover in surprisingly short time, while bumps and bruises which others might feel for a week seem to disappear over night. Such are the advantages of a vigorous physical condition. The bones, like other tissues of the body, may be influenced in this way.

If one really desires to enlarge a particular bone, he can do so by subjecting it to repeated and long continued strain. If he has a slight wrist and wishes to strengthen and enlarge it, he could do so by persistent practice of exercises which place a decided strain upon the wrist without injuring it. Bricklayers and blacksmiths all have good wrists. Mountaineers all have stout knees and sturdy limbs, and a continual life on the mountains, climbing, hunting and struggling over rocky passes, would strengthen anybody's legs, both with reference to muscles and bones. As for the bones, however, the greatest effect could be accomplished only by beginning before maturity. In most cases it is not advisable to attempt to enlarge or alter the bones, except where there is some deformity, in which case corrective exercise, persisted in, will usually accomplish marked results in one or two years, sometimes in less time.

The Muscular System.—In the effort to bring about improved health and increased vitality, we depend upon nothing so much as

the voluntary use of the muscular system. This is directly under our complete and wilful control, and in order that we may employ it successfully and intelligently, not only for strengthening and perfecting the muscles themselves, but for increasing the energy and improving the quality of all other organs, tissues and systems of the body, it is important that we know and understand the nature of this important part of our make-up.

In colloquial speech we commonly differentiate between the muscular system and the various internal organs of the body, such as the stomach, heart and lungs. However, a muscle is really an organ and an important one—an organ of motion. Without our muscular tissues, which constitute nearly one-half of our total body make-up, we not only could not move a single member of the body, but the functions of our various internal organs and the vital processes of life could not proceed for an instant.

This power of voluntary movement is perhaps the first thing that distinguishes animal life from the vegetable world. The tree is an example of organic life, as distinct from what we term inorganic matter. The tree has the power of absorbing and utilizing moisture, sunshine and air, of breathing through its leaves, of growing, and of giving off its life-perpetuating fruit or seed; but it has no power of movement, being utterly at the mercy of external forces.

All forms of animal life, however, have the power of moving themselves of their own volition. The more highly developed the form of life, the more varied and complex are the movements of which it is capable, men and women being possessed of the most extraordinary and wonderful accomplishments because of this. The marvelous manual dexterity and piano technique of the accomplished pianist are simply a matter of muscular proficiency and training. The divine touch of the great artist, as he expresses his very soul in his masterpiece, is placed upon the canvas by means of the muscles that guide his gifted hand. Nor is it simply and solely the important things of life, however, but also the trifling and commonplace actions, more important than the seemingly big things, depend, all of them, upon this elaborate system of organs of motion which we call muscles.

As we have already shown, we cannot move nor exist without muscular action. It is the essence of natural locomotion. In the more primitive conditions of life, we could not build fires or houses, or clothe ourselves, or even seek refuge in the remote warm corners of a cave, as a protection against cold, without muscle. We could not

put our food into our mouths, we could not chew it or swallow it, and we could not digest it without muscular action. We could not lift our lids to open our eyes, we could not turn our eyes to see, nor focus the sight upon objects far and near, without the use of muscles. Even the heart, universally regarded as the most vital of all organs, is a muscular structure, working tirelessly and with greater persistence and fidelity than any clock, for the entire life-span, a piece of muscular machinery without which the blood could not circulate, and to which any injury usually means the instant death of the individual.

It is true that the impulses which actuate the muscles come from the brain, and that their actions depend primarily upon the nervous energy thus imparted. They are still just as important for their purposes, even if regarded as only the instruments of the mind. It is also true that some of the muscular tissues concerned in these various operations casually mentioned are of the involuntary kind, but they only serve to show the importance and dignity of these tissues as an important factor in the making of a human. Muscle is not a low-grade tissue, and it should be self-evident that the more perfectly the muscles and tissues of the body are trained and cultivated, the more efficient will they become in themselves, and the more capable the individual whose will they obey.

There are still many, the number happily becoming less and less, who tell us with a tedious reiteration that what we need is brain and not brawn, mental and not muscular strength. But this is like saying to the builder of a great building that he should go ahead first to build the dome; that he is wasting time on the foundation, but that he should go ahead and erect the upper part of the building without it. We know, however, that in erecting great buildings more time is sometimes spent upon building the foundation right than in putting up and completing all the rest of the structure. And this is even more important in the case of the body.

Perhaps the importance of a perfect and normal condition of the muscular system lies not so much in its value for the purpose of maintaining external strength and manual efficiency as in the more vital considerations having to do with the chemical and functional processes of life. These will be apparent at once when we observe that the muscular system of a normal and healthy human body comprises something between 40 and 45 per cent. of the total bulk or nearly three times more than any other system or tissue of the body. When we realize

that perhaps two-thirds of our vital heat is produced by the muscles, and that the greater part of our food is consumed in them, we can begin to appreciate their tremendous physiological importance. We will see how imperative is the requirement that we should be and continue to be muscularly perfect, or as nearly so as possible. With this aspect of the subject in mind, we will see, as we may never have seen before, that in neglecting to take at least a fair and healthful amount of active exercise daily, we may be incurring extremely heavy penalties.

It is impossible to be muscularly wrong, and to be right in other respects. When we say muscularly perfect we do not mean an extreme or abnormal development, but a normal condition of every part of the body, a natural, vigorous degree of strength, and, in short, a physical condition in which we may compare favorably with perfection of life among the lower animals.

Voluntary motion by animals, as we shall see later, comes through the exercise of some degree of mental power, but the finest of nervous organizations would be incapable of inspiring any motion if it were not for the coordination of muscles.

The more muscles there are trained the greater will be the varieties of motion that are possible. The firmer and larger the muscles are the greater the strain that they will endure. If the muscles are trained in toughness alone the possessor may have great strength that will be equal, for instance, to carrying great loads, or lifting great weights. But if the muscles are so trained that they do not become merely tough but elastic as well, he who has such muscles will display great agility in the different methods of exercising his strength. Finally, he who is intelligent, and who has a nervous system that is perfectly balanced, so that the brain may direct, and the nerves may carry the orders to the muscles, will be strong, agile and skilful in anything that involves muscular motion.

The voluntary muscles of the body are red in color, although of differing shades of red. There is another characteristic of the voluntary muscles that is apparent to the eye in the larger muscles, but which must be found with the aid of a microscope in many of the smaller muscles. This is the fact that voluntary muscles have one characteristic of structure in common: They are *striated*—that is, striped. These striated muscles may be likened somewhat to the spiral spring, and it is this characteristic of structure that makes the contraction of the muscles possible.

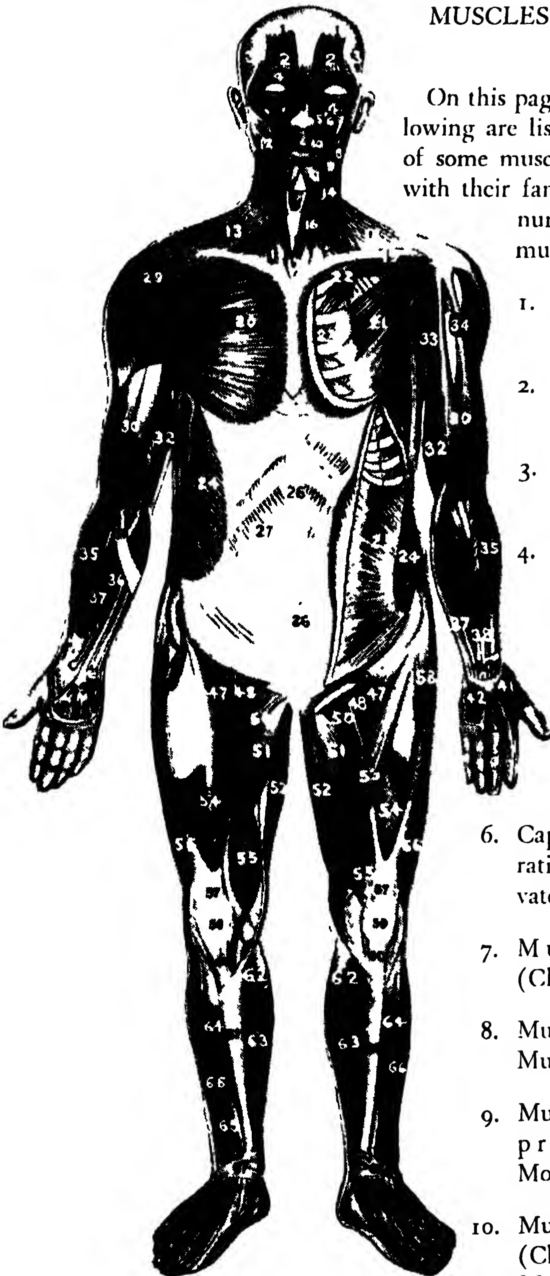
The essential principle of all muscle, whether voluntary or involtary, is this power of contracting. Raise your fist so that it touches the shoulder, and several sets of muscles have been contracted to make the movement possible. Straighten the arm again, and other sets of muscles have been contracted in order to bring the arm out straight from the shoulder.

Merely for the sake of convenience, we speak of a muscle as if it were one single and complete affair by itself. Yet, if we place a cross-section of even a very small muscle under the lens of the microscope, we find that it is made up of a bundle of a great many fibers. Each fiber is enclosed in and protected by a very thin, transparent sheath known as the sarcolemma. And each fiber is made up of many much smaller threads of tissue which are designated as fibrillæ. The striated appearance is found even in the fibrillæ. Now we find that fibrillæ, bound up in the sarcolemma, form the fibers, which are bound together in bunches known as fasciculi, and that these latter are in turn bound together and enclosed in sheaths. A muscle, therefore, is a number of fasciculi bound together, and often very intricately.

Upon further examination we find that each muscle, however small, has its own complete and even intricate set of nerves, lymphatics, and blood vessels. It is the presence of these blood vessels that gives to the voluntary muscles their red color. Of the lymphatics more will be said in later discussion; they are an important part of the nutritive mechanism of the body. Blood vessels, lymphatics and nerves that are on missions to other parts of the body do not pass through the voluntary muscles, but between them.

These voluntary muscles cover the bones, but are not directly attached to them. At either end of a muscle may be found a white connective tissue, the tendons. These tendons are familiar to all who have cut up raw meat. When examined closely it will be seen that there is a gradual merging of the fasciæ, or connective tissue forming the sheaths around muscles, into the tendons.

Very different in appearance are the involuntary muscles. They are smooth and regular in appearance; they are band-shaped, with somewhat of the appearance of gutta-percha. They are not striated (striped). A powerful microscope reveals the fact that these involuntary muscles are not made up of fibers, but are composed of long, needle-shaped cells that form flat textures like sheets of paper. Another peculiarity of the involuntary muscles is that they have no tendon attachments.



MUSCLES OF THE HUMAN BODY

On this page and the two pages following are listed the scientific names of some muscles of the human body, with their familiar equivalents. Key numbers show location of the muscles in the illustration.

1. Epicranial aponeurosis (Membrane of the Scalp).

2. Musculus frontalis (Forehead Muscle).

3. Musculus temporalis (Temple Muscle).

4. Musculus orbicularis oculi (Closing Muscle of Eye).

5. Caput angulare quadrati labii superioris (Elevator of Upper Lip and Nostrils).

6. Caput infraorbitale quadrati labii superioris (Elevator of Upper Lip).

7. Musculus zygomaticus (Cheek Muscle).

8. Musculus risorius (Smiling Muscle).

9. Musculus triangularis (Depressor of Angle of Mouth).

10. Musculus orbicularis oris (Closing Muscle of the Mouth).

11. Musculus quadratus labii inferioris (Depressor of Angle of Mouth).

12. Musculus masseter (Chewing or Masticating Muscle).

13. Musculus platysma (Platysma myoides; Large Sheet Muscle of Throat).

14. Upper Portion of Musculus omo-hyoideus.

15. Musculus trapezius (Table-shaped Muscle).

16. Internal Layer of Neck Muscles.

17. Musculus sternothyroideus (Sternothyroid Muscle).

18. Musculus sternocleidomastoideus (Sternocleidomastoid Muscle).

19. Clavicle (Collar-bone).

20. Musculus pectoralis major (Large Breast Muscle).

21. Musculus pectoralis minor (Small Breast Muscle).

22. Musculus subclavius (Muscle under Collar-bone).

23. Musculus intercostalis (Intercostal [between ribs] Muscles).

24. Musculus obliquus externus abdominis (Outer Oblique Abdominal Muscle; Cut off on left side).

25. Musculus obliquus internus abdominis (Inner Oblique Abdominal Muscle).

26. Linea alba (White Line of Abdomen).

27. Sheath of musculus rectus abdominus.

28. Umbilicus (Navel).

29. Musculus deltoideus (Deltoid Muscle).

30. Musculus biceps brachii (Two-head Arm Muscle).

31. Tendon of musculus biceps brachialis.

32. Musculus triceps brachii (Three-head Arm Muscle).

33. Coracobrachiales (Crow-Beak Arm Muscles).

34. Insertion of musculus pectoralis major.

35. Musculus brachioradialis (Radial Arm Muscle).

36. Musculus flexor carpi radialis (Flexor Muscle of the Wrist).

37. Musculus flexor digitorum sublimis (Superficial Flexor Muscles of Fingers).

38. Musculus flexor pollicis brevis (Flexor of the Thumb).

39. Aponeurosis palmaris (Fan-like Spreading Ligament of the Palm).

40. Tendons of Flexor Muscles of Hand.

41. Musculus opponens pollicis (Muscle That Brings Thumb before Fingers).

42. Musculus abductor digiti quinti (Abductor of Little Finger).

43. Musculus transversus thoracis (Contracts Chest).

44. Diaphragm.

45. Musculus transversus abdominis (Internal Diagonal Abdominal Muscle).

46. Musculus posas minor (Quadrangular Loin Muscle, often absent).

47. Musculus iliacus (Inner Hipbone Muscle).

48. Musculus psoas major (Large Muscle Flexing Thigh).

49. Ligamentum inguinale (Poupart's Ligament).

50. Musculus pectineus (Adducts and Helps Flex Thigh).

51. Musculus adductor longus (Long Adductor Muscle of Thigh).

52. Musculus gracilis (Thigh Adductor, Flexor Rotator).

53. Musculus sartorius (Tailor Muscle).

54. Musculus rectus femoris (Median portion of quadriceps femoris, Leg Extensor).

55. Musculus vastus medialis (Inner portion of quadriceps femoris).

56. Musculus vastus lateralis (Outer portion of quadriceps femoris).

57. Tendon of musculus quadriceps femoris (Leg Extensor).

58. Musculus tensor fascia latæ (Tensor of fascia lata).

59. Patella (Kneecap; kneepan).

60. Ligamentum patellæ (Kneecap Ligament).

61. Tibia (Shin-bone).

62. Musculus gastrocnemius (Two-headed Calf Muscle).

63. Musculus soleus (Push Muscle of the Calf).

64. Musculus tibialis anterior (Front Shin Muscle).

65. Musculus extensor hallucis longus (Long Extensor of Great Toe).

66. Musculus extensor digitorum longus (Long Extensor of Toes).

67. Annular Ligament of Ankle.

68. Tendons of musculus extensor digitorum longus.

Unattached to bones, they require no tendons. Involuntary muscles have the same characteristic of contraction that is possessed by the voluntary muscles; they also respond to irritation, although to a less marked degree than do the voluntary muscles.

Of all the involuntary muscles the foremost examples are those found in the heart, that organ which never ceases work for an instant while life lasts. Other involuntary muscles are those of the lungs, which carry on the work of respiration even when we are asleep. So, too, do the stomach, the liver and kidneys, the intestines and all of the other vital organs perform their various tasks through the constant contractions of their involuntary muscles. Thus the churning of the stomach brings about the performance of digestion. The involuntary muscles of the intestines force the contents along. The blood vessels and the lymphatics perform their offices by the aid of involuntary muscles.

Whether or not the involuntary muscles can be made, by a direct effort of the will, to take on some of the voluntary characteristics is a question that cannot be decided with finality. It is not to be thought that the involuntary muscles can act wholly independent of the control of the nervous system; in fact, it is well known that the possessor of a finely organized nervous system will have healthier involuntary muscles, and this would seem to indicate complete nervous control of the involuntary muscles. We know that one can increase his heart beat by breathing much more rapidly, but here the involuntary muscles are forced into action by the voluntary muscles. In this way the involuntary muscles would seem to represent a finely adjusted automatism. Fundamentally, however, they really depend absolutely upon the control of the nervous system. When influenced by the voluntary muscles in this seemingly automatic action, it is really the nerves which are first affected, they acting in turn upon the involuntary muscles. Let anything happen to the nerves and the involuntary muscles are motionless. A blow in the solar plexus, for instance, a sympathetic nerve center, will temporarily paralyze the action of the involuntary muscles of the heart and of respiration. In short, these involuntary muscles, like all others, depend primarily upon the brain and nervous system, but in a subconscious manner instead of being subject to conscious volition.

The most pronounced characteristic of either voluntary or involuntary muscles is their apparent "irritability." Any form of irritation that is applied to a muscle causes it to contract. This is seen, readily

enough, by touching a muscle sharply. There are other forms of irritation than mere contact. Excessive heat will cause quick and sharp muscular contraction. When one is insensible his muscles will contract—twitch—if a strong current of electricity be passed through his body.

Vigorous expiration, also, forcing the blood through the body, will cause the muscles to twitch on account of the irritation caused by the passage of blood against the muscles, and also on account of the other irritation produced by the involuntary muscles in motion in the blood vessels.

Perhaps we should make a distinction here, for the reason that in some cases what may seem to be the irritability of the muscle is only the result of the action of the nerves contained in it. The nerves in such a case are affected by the irritation or external influence, in turn causing the muscle to contract by reflex action. In the case of an electrical current, however, this will act directly upon the muscular tissue, causing it to contract in much the same manner as by the stimulus of "nerve-force," though without the control and direction that come through the nerves from the brain. The best proof of this is that electricity will cause contraction of the muscles of a dead person.

Muscles are said to have an "origin" and an "insertion"—terms that are much used. The origin of a muscle is its source, or the place where it begins. The insertion is the spot where the farther end of the muscle is attached. For instance, in an arm muscle, the origin is the point on the bone from which the muscle proceeds; the insertion is the point which, by muscular contraction, is brought nearer to the origin. The voluntary muscles always end in tendons at the points of origin and insertion.

In the limbs the "tendon of origin" is usually that attached to the trunk of the body, or nearest it, while the other tendon, to be called the "tendon of insertion," is the one at the farther end of the muscle farthest away from the body.

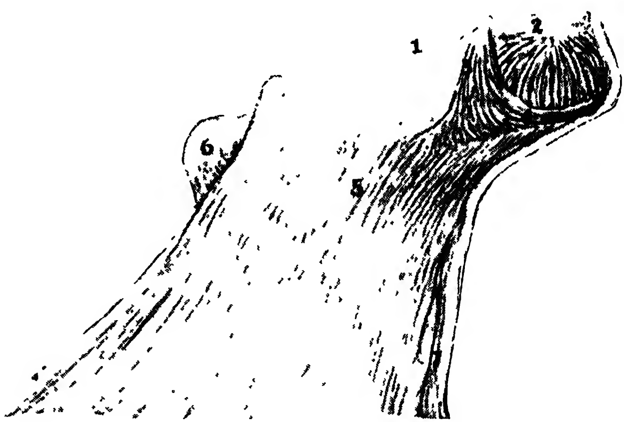
Muscles are divided into several groups, according to their position, structure and functions. The commonest of the voluntary muscles are the recti, or straight. Then we have the deltoid, or triangular shaped, the brachial or arm muscles, and the intercostal muscles between the ribs. The biceps are two-headed muscles and the triceps three-headed.

The muscles of the face are by no means unimportant in relation

to the work for which they are designed, but we need not enter into any detailed study of them here. Nor is it necessary to study carefully all of the nine groups of muscles that are found in the neck. Most of these muscles are of interest only to the dissector and the surgeon. The platysma myoides is a muscle covering all others in the front of the neck. It is conspicuous when vigorously contracted. The two important pairs of muscles to be studied and watched in the development of a strong neck are the splenius and the sterno-cleido-mastoid. If these muscles be strong, as may be ascertained easily by feeling them in motion under the skin, then one may be satisfied that the other muscles are also in good condition and that the neck of the pupil will have all of the muscular power that should be developed.

It will be remembered that the twenty-four vertebræ of the spinal cord are divided into three groups, as follows: Seven cervical or neck vertebræ, beginning directly at the base of the head; below these, twelve dorsal vertebræ, belonging to the back proper, and five lumbar vertebræ in the small of the back. It is well to study the exact positions of these vertebræ and to keep them in mind at all times in connection with the muscles and nerves, particularly the latter, that have their starting point from the spinal column.

The splenius muscle has its origin in a single tendon, very narrow and pointed in form. It arises from the large ligament (*ligamentum nuchae*) that passes down the back of the neck over the spine, proceeds upward

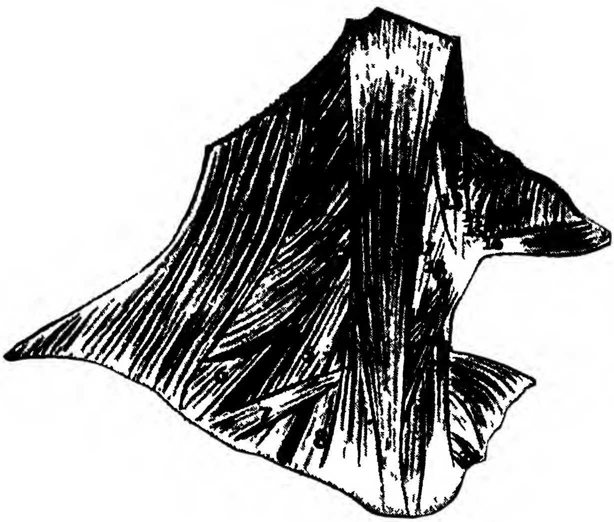


Here is pictured the general arrangement of some of the muscles of the front and side of the chin and the neck.

1. Risorius
2. Quadratus labii inferioris
3. Triangularis
4. Transversus menti
5. Platysma (myoides)
6. Sternocleidomastoideus (right)
7. Sternocleidomastoideus (left)

from the last cervical and the upper six dorsal vertebræ, and broadens on the way upward. As it broadens the splenius divides into two broad bands of associated muscle, the splenius capitis and the splenius cervicis. The capitis has its insertion at the temporal bone over the ear. The insertion of the splenius cervicis is at the second, or sometimes at the third, upper cervical vertebræ.

The splenii, both the capitis and cervicis, are the muscles felt at the back of the neck between the mastoid muscle and the spine. Their motions are readily felt when the head is turned to one side, or when the head is nodded. Anatomically the splenius is designated as one of the trunk muscles, but its action is felt most readily in the neck.



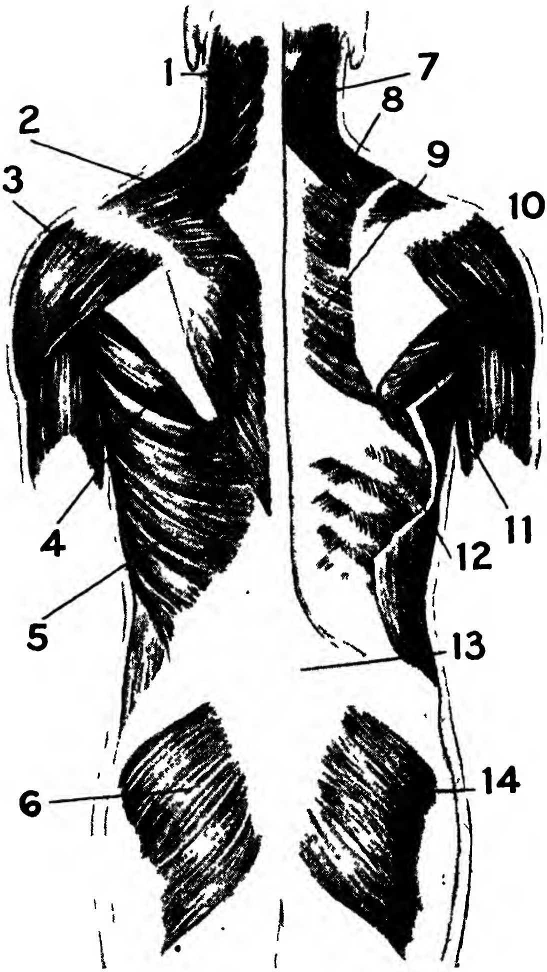
This diagram, with its key numbers, shows the location of muscles of the side and also in the front of the neck.

1. Sternocleidomastoideus (right)
2. Splenius capitis
3. 4. Trapezius
5. Scalenus medius
6. Scalenus posterior
7. Omohyoideus (posterior belly)
8. Scalenus anterior
10. Styloglossus
11. Stylopharyngeus
12. Stylohyoideus
13. Digastricus (posterior belly)
14. Hyoglossus
15. Mylohyoideus
16. Digastricus (anterior belly)
17. Constrictor pharyngis inferior
18. Thyreohyoideus
19. Omohyoideus (anterior belly)
20. Sternohyoideus
21. Sternocleidomastoideus (left)
22. Trapezius
24. Omohyoid (posterior belly)

On the other hand, the sterno-cleido - mastoid muscle, found on either side of the neck, is a true neck muscle. It is readily found by placing the hand just back of the ear. Any pronounced movement of the head will bring the mastoid into prominence under the fingers. This muscle runs obliquely downward to the front. At the center it is thick, and feels like a stout rope beneath the fingers. At each

extremity it is broader and thinner. One portion of the lower mastoid has its origin at the head (manubrium) of the sternum (breast-bone). Another portion of the mastoid has its origin at the upper surface of the collar-bone. The two portions have their common insertion back of the ear.

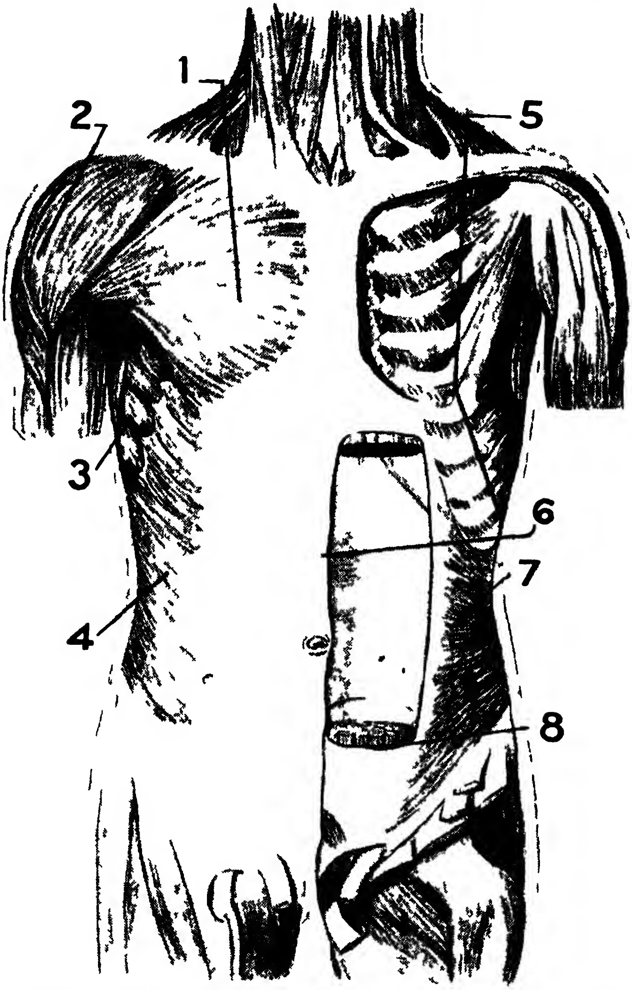
The trapezius is a very large muscle of triangular shape, and reaching all the way from the base of the skull to the lower portion of the dorsal region. It is a flat muscle just underneath the skin, and is composed of a great network of smaller muscles. The origin of the trapezius is a broad one, this muscle arising from the base of the skull; from the great neck ligament already mentioned, and from the seventh cervical and all of the dorsal vertebræ. The insertion is on the clavicle and



The numbers appearing on this drawing indicate important muscles of the back immediately beneath the skin.

1. Sternocleidomastoideus
2. Trapezius
3. Deltoideus
4. Infraspinatus
5. Latissimus dorsi
6. Gluteus maximus
7. Splenius capitis
8. Rhomboideus minor
9. Rhomboideus major
10. Deltoideus
11. Infraspinatus
12. Intercostales
13. Lumbar aponeurosis
14. Gluteus maximus

on the acromion process of the shoulder-blade. In most of its extent the trapezius is fleshy, but at the points of origin and insertion the ends of the muscle are found in tough tendons. The function of the trapezius is to control the backward movements of the head and shoulders. In lifting or in pulling the trapezius plays its important part; hence exercise for the trapezius should involve lifting, as of weights and pulling, as in tugs of war.



This drawing shows some of the more important muscles of the front of the body.

1. Pectoralis major
2. Deltoideus
3 Serratus anterior
4. Obliquus externus
5. Intercostales
6. Linea alba
7. Transversus abdominis
8. Rectus abdominis (muscle removed from cavity shown)

The linea alba, or white line of the fascia or sheath, serves as a covering of the abdominal muscles.

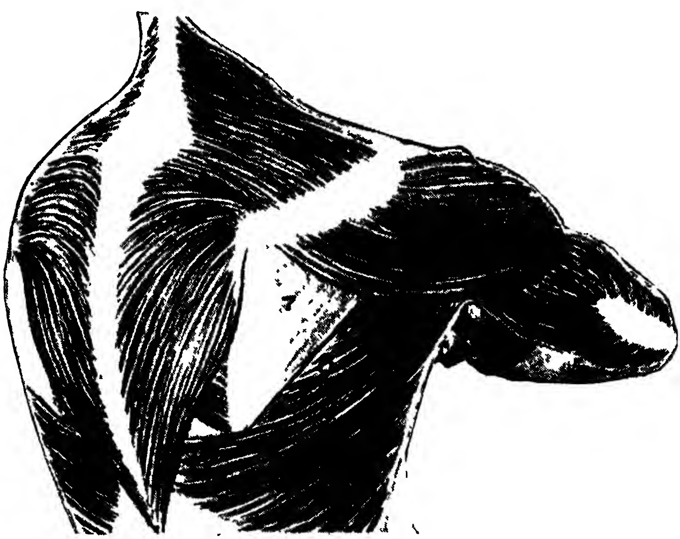
On either side of the lower half of the back we find a muscle that corresponds somewhat to the trapezius in shape and extent, at least, and this is the *latissimus dorsi,* which is also just beneath the skin, except where, at its upper end, it passes under the trapezius. The origin of this lower back muscle is at

the six lower dorsal vertebræ, the lumbar vertebræ, the sacrum and at the upper edge of the hip-bone.

The latissimus dorsi, like its mate, the trapezius, is a complicated network of muscles, whose windings it is unnecessary for the reader to follow. It finds its insertion near the upper end of the humerus, the large bone of the upper arm.

The function of the latissimus dorsi is to draw the arm downward and backward. From this statement it will be realized what a great variety of exercises can be utilized in strengthening this muscle. Any form of systematic exertion that pulls the arms downward or backward is indicated. The schoolboy usually thinks that he "chins" himself entirely with the biceps, but it is not true. Work on the bars, "chinning" for instance, or climbing ladders or ropes, bending, swaying or twisting the trunk, dumb-bell work that throws the elbows and shoulders back—these and countless other forms of exercise employ this muscle and are valuable for strengthening a "weak back."

The rhomboid muscles are found readily in any well-developed



Numbers here given indicate some of the larger muscles of the back and shoulder.

1. Trapezius
2. Deltoideus
3. Triceps brachii (long head)
4. Triceps brachii (lateral head)
5. Brachioradialis
6. Teres minor
7. Infraspinatus
8. Teres major
9. Latissimus dorsi

back. Let the subject stand with elbows at his sides, forearms horizontal and fists clenched. With the arms tense let the subject move his elbows and shoulders back. The rhomboids will become apparent as a series of small ridges of muscles, showing outwardly in an almost perpendicular position, between the two shoulder-blades.

The rhomboids occur just underneath the trapezius, and assist the latter in its work. Hence the same kinds of exercises are called for as in the case of the trapezius. The minor rhomboids originate in the ligamentum nuchae, already referred to, and in the seventh cervical and first dorsal vertebræ, and their insertion at the root of the spine or ridge of the scapula. The major rhomboids have their origin in the first four or five of the upper dorsal vertebræ, and their insertion in a thin arch of tendon that is attached to the spine of the scapula.

Now, let us briefly consider the muscles found at the front of the trunk. First of all are the pectorals, or chest muscles, which cover the chest. The upper and more important of the pair on either side is the major pectoral, or *pectoralis major*. Its origin is from the clavicle near the sternum and from the sternum itself as far down as the cartilage attachments of the sixth or seventh ribs. This major pectoral is fan-shaped and terminates in a thick and powerful tendon, some two inches broad, inserted at the outer edge of the upper end of the humerus.

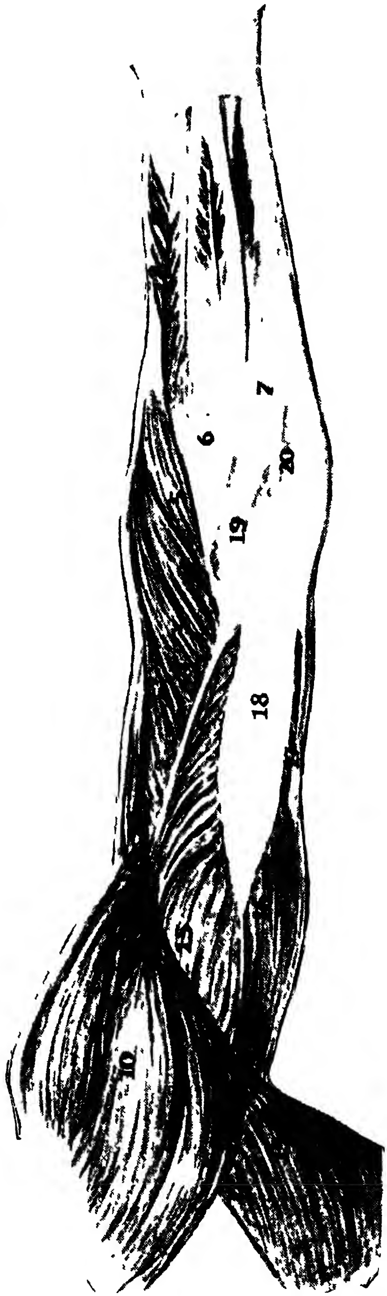
The origin of the minor pectoral (*pectoralis minor*) is at the third, fourth and fifth ribs, near their cartilages, and the insertion in a tendon that connects with the coracoid process of the shoulder-blade. The coracoid process, you will remember, is the bony projection from the front of the scapula which helps to protect the glenoid cavity in which the head of the humerus rests.

It is the work of the major pectoral to draw the arm across the front of the chest, while to the minor pectoral is assigned the work of depressing the shoulder-point. A somewhat mild but effective exercise for the pectorals, in which, also, the intercostal (rib) muscles are benefited, is found in deep and long-continued breathing of outdoor air, in which the chest is repeatedly raised and lowered and forced outward.

The intercostal muscles are set rather deeply between the ribs and assist in the expansion of the chest during such free breathing as may call for this expansion of the chest.

MUSCULATURE OF THE ARM WHEN EXTENDED:

1. Biceps brachii.
2. Brachialis.
3. Brachioradialis.
4. Extensor carpi radialis longus.
5. Extensor carpi radialis brevis.
6. Extensor digitorum communis.
7. Extensor carpi ulnaris.
8. Abductor pollicis longus.
9. Extensor pollicis brevis.
10. Deltoideus.
12. Teres minor.
13. Teres major.
14. Latissimus dorsi.
15. Lateral head of triceps brachii.
16. Long head of triceps brachii.
17. Median head of triceps brachii.
18. Tendon of triceps brachii.
19. Anconeus.
20. Flexor carpi ulnaris.



The serratus anterior arises from the upper eight ribs a little forward from the sides of the body, and finds its insertion in the shoulder-blades.

Of great importance are the oblique external muscles of the abdomen. These pass down from the sides obliquely across the abdomen toward the front. They are broad, flat muscles that are used in the various bending movements of the trunk. Behind them are the internal oblique muscles of the abdomen, which aid the external muscles in their tasks. The character and location of these muscles may be studied in one's own person.

The *rectus abdominis,* or straight abdominal muscle, is to be found on either side of the central perpendicular line of the abdomen. It is a long, flat muscle which extends the whole length of the abdomen, and the work of the pair is to press the intestines inward, as in abdominal breathing, to depress or pull the shoulders and chest downward, or, when lying on the back, to raise the upper body to a sitting position. This is the muscle that gives the great ridge-like appearance to the stomach, when well developed and contracted.

The study of the muscles of the arm will probably be found very interesting inasmuch as they indicate so clearly both the general structure and the character of muscular action. Their actions can be felt and seen very clearly from the outside and the swelling of the biceps in the bending of the arm is one of the most familiar facts of childhood.

It should be remembered, however, that in many of the movements in which the upper arm is concerned, we do not depend so much upon the muscles of the arm itself (with the exception of the deltoid and its action) as upon those of the upper trunk, of the chest, back and shoulders. For instance, in striking a blow forward, we depend largely upon the pectoral muscles for bringing the arm forward, the extensor of the upper arm only straightening the member as it is brought forward to strike the blow. The heavy hitting boxer, therefore, does not depend upon his arm muscles merely. The similar participation of the latissimus dorsi, and other trunk muscles in the movements of the arm, has already been noted. It will be seen that, with the exception of the deltoid, the muscles of the upper arm are concerned with the movements of the lower arm or forearm, and the muscles of the latter with the movements of the wrist, hand and fingers.

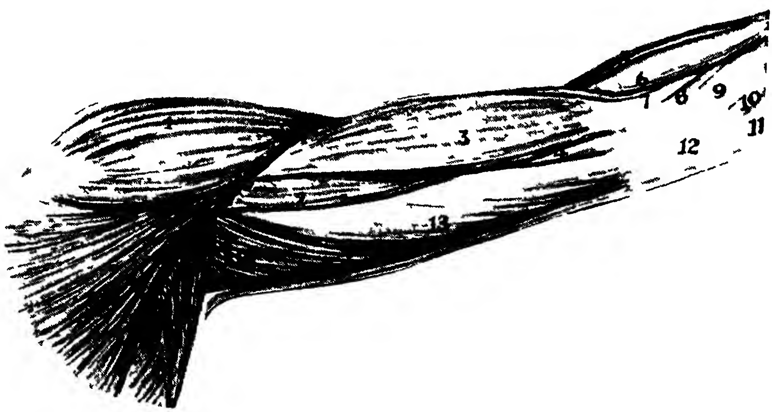
Stand with the arm hanging limply at the side, the open palm of

the hand resting against the side of the leg. Clench the fist, raise it quickly to the shoulder, and strike out hard at some imaginary foe. The performance of this simple action has called into play a complicated system of muscles which control many acts involved in the sustenance and protection of human life, muscles that are brought into constant use in every one of the thousands of tasks that make up the sum total of civilization.

The main causes of the difference between man and the lower animals are that man has a better brain with which to decree the acts of his life, and that he has *hands* with which to execute the orders received from his brain. And the hands are directly controlled by the muscular movements of the arms.

Biologists declare that the use of the muscles of the body, but especially the manipulation of the hands and other external objects through the hands, has been one of the most important of all factors in the education of the human brain. This is true not only with reference to the race, but in the case of each individual human during his period of infancy. The man who can "do things" with his hands usually has a level head.

In the very act of raising the arm from the side the use of one of the arm muscles was necessary. This is the *deltoid* muscle, which

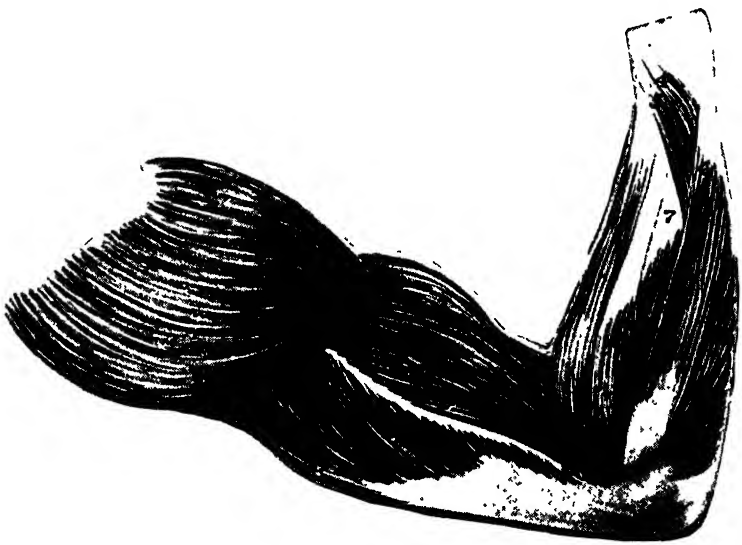


Here are shown muscles of the arm when extended.

1. Deltoideus
2. Coracobrachialis
3. Biceps brachii
4. Brachialis
5. Extensor carpi radialis longus
6. Brachioradialis
7. Tendon of biceps brachii
8. Pronator teres
9. Flexor carpi radialis
10. Palmaris longus
11. Flexor carpi ulnaris

has been mentioned previously, a flat, strong, triangular mass of fibers that is found on the outside of the upper shoulder. The play of this muscle may be felt plainly by placing the hand of the other arm in place over the top of the shoulder, then raising and lowering the arm rapidly.

Covering nearly all of the front side of the upper arm lies the muscle that is best known and most interesting of all to the novice in physical culture. This is the *biceps brachialis*—so called because it is two-headed. By "two-headed" is meant that the muscle has a dual beginning or head. These beginnings are tendons; there are two, a long and a short one. The short tendon has its origin in the coracoid process of the shoulder-blade. The long tendon has its origin in the glenoid cavity, and passes over the head of the humerus or upper bone of the arm. Each tendon merges into a long, muscular "belly," as the fleshy part of a muscle is termed. These two "bellies" lie close together,



The numbers in this illustration show the muscles used in flexing the arm.

2. Trapezius
3. Deltoideus
4. Extensor pollicis brevis
5. Abductor pollicis longus
6. Extensor digitorum communis
7. Extensor carpi radialis brevis
8. Extensor carpi radialis longus
9. Brachioradialis
10. Extensor carpi ulnaris
11. Anconeus
12. Brachialis
13. Triceps brachii (lateral head)
14. Triceps brachii (long head)

although they can be distinguished easily from each other until they are within some three inches of the hinge joint of the elbow.

In general contour the biceps is a long spindle. The insertion of the biceps is in a single tendon that is attached to the upper end of the radius, the smaller and outer of the two bones of the forearm. You will remember, of course, how the upper ends of the ulna and radius are so joined together as to effect a hinge joint with the lower end of the humerus and it will be understood from this how the biceps operates to bring up the forearm.

There is another very important muscle of the arm of which not so much is heard in the boastings of the schoolboy as of the biceps. This is the *triceps brachialis.* It is on the under side of the upper arm, and, as its name implies, is three-headed. The middle tendon of the triceps has its origin on the scapula, just below the glenoid cavity; the external head rises from the upper shaft of the humerus, on the under side, and the internal, or short head, has its origin also from the shaft of the humerus. The main insertion of the triceps is in an attachment with the head of the ulna, although a set of fibers from the tendon attach lower down in the back of the forearm.

It is the task of the biceps to bend, or "flex," the forearm upon the upper arm. This is the familiar movement when "showing one's muscle." The function of the triceps is to straighten the arm out again; hence it is called an extensor. The biceps and triceps, as we see, are exactly opposed to each other.

Besides the biceps there is another important muscle in the front portion of the upper arm, the one known to anatomists as the *brachialis anterior.* Its main position may be detected readily by the examination of one's own arm while steadily flexing and extending it. It is a broad muscle that covers the elbow and the lower half of the front of the humerus. The origin of this muscle begins at the insertion of the deltoid, and extends to within an inch of the elbow joint. The insertion is in the ulna. The function of the brachialis anterior is to flex the elbow.

In the forearm the muscles that need to be considered principally may be divided into four groups, and all of these have the function in common of controlling the wrist and hand. The movements of all these sets of muscles may be followed with ease through the covering of skin.

Rest the elbow and the back of the hand on the table. Still letting the wrist lie on the table, bring the palm of the hand up toward the

elbow. The muscles that move during this exercise will be found on the front and the inside of the forearm. These muscles are known as the flexors, since it is their function to bring the palm of the hand up toward the forearm.

Now, extend the hand again, until it is in line with the forearm and the back of the hand rests once more on the table. The muscles that move now will be found on the front of the forearm, near the outer edge and along the outer edge of the forearm. It is the work of these muscles to extend the hand, and these are known as the extensors.

Both the flexors and the extensors can be felt to still better advantage if you extend your arm horizontally forward. Holding the arm somewhat rigid, with the hand straight out at first, flex the palm up toward the elbow; then extend it. If the arm be held tense, it will be noted that there is slight fatigue on the inner edge of the forearm when the hand is flexed, with the same perception of fatigue on the outer edge of the forearm when the hand is slowly extended.

Next rest the forearm and open palm of the hand on the table. Without raising the forearm, turn the hand over so that the back of the hand rests upon the table. This way of turning the hand is called supination. The supinator muscles that make this turning of the wrist possible will be found in the front side of the forearm.

After you have thus located the supinator muscles, and have felt their movements, turn the hand back again so that it rests upon the palm with the back of the hand up. This movement is known as pronation, and the muscles that accomplish it are called the pronators.

Both the supinator and pronator muscles are attached to the front of the radius, the smaller and shorter bone of the forearm. It will be remembered that the base of the radius articulates with the carpal bones of the wrist, and it is through the contraction of the muscles just discussed that the movements of the wrist and hand are compelled.

When these four sets of muscles are well-developed and healthy it is said that one has a strong wrist. Lack of development in these muscles is responsible for weakness of the wrist.

Since these muscles have so much to do with the movements of the hand, it is highly important that they should be trained to a high degree of excellence. An arm that is strong at every other point is weak, indeed, if it be lacking at the wrist.

Gripping and lifting work will be effective. Any form of exercise that forces the wrists to turn freely, rapidly, and under tension, is indi-

cated. Work on the bars, and tugging, are to be commended for this purpose, as well as climbing, especially on ladders and on ropes. The muscles that make for "strong wrists" do not yield readily to treatment. A gymnasium pupil with weak wrists must work some time before he can hope to note a great improvement.

Rowing and ball-pitching do much for the weak wrist, but fencing is *par excellence* the exercise of them all that is needed to insure the building up of a wrist that shall be at once strong, flexible and supple. It is to be regretted that fencing with the use of one arm involves the development of only one wrist. The other wrist, therefore, should receive its full share of benefit by being more employed than the right in other forms of wrist training.

If one takes up fencing or broad-sword work for the sake of exercise, then he should learn the game with either hand, practicing with both, so that he may be symmetrically developed and equally strong on both sides.

When we come to consider the anatomy of the muscles of the hand we find it impossible to learn much unless we consider these muscles in connection with those of the forearm, some of which we have just considered.

Let us examine, first of all, the muscular control of the thumb. On the front or palm side of the thumb we find a short muscle at the outer edge known as the abductor of the thumb. Its purpose is to draw the thumb inward and toward the palm. On the inside edge of the thumb, nearest the fingers, is a muscle known as the thumb's flexor—the *flexor longus pollicis.* While it is the task of an abductor muscle to draw the member away from the center, the flexor is always the muscle that causes a member to fold over on itself. Thus the thumb flexor is used when the thumb is bent inward, as in the ordinary clenching of the fist. And thus the other muscle described, the abductor, draws the thumb away from its center, and necessarily toward the palm. On the extreme outer edge of the thumb is a short muscle (the *opponens policis*) that acts in opposition to the abductor, thus bringing the thumb straight again when employed.

In the forearm is found a muscle that is most important to the successful work of the palm of the hand, and that is known as the *palmaris longus.* It is a long and narrow muscle rising in the condyle of the humerus, the condyle being the extremity of that bone which fits into the socket-like heads of the ulna and radius to form the hinge joint of the elbow. The course of the palmaris longus is at first

along the ulnar side of the forearm, and then obliquely into the hand at about the center of the wrist. The tendon of this muscle ends partly in the palmar fascia. It will be remembered that fascia is the name given to sheaths that cover muscles. This palmar fascia is a common sheath covering the muscles of the palm of the hand. It branches off into four slips, each connecting with one of the four fingers. Each slip gives off numerous muscular fibers that extend to the skin of the palm and of the fingers.

There are two lateral sections of the palmar fascia. One, on the thumb side, covers the muscles of the ball of the thumb; on the little finger side the lateral portion of the palmar fascia covers the muscles of the little finger.

Now it will be understood how much of the movements of the hand is controlled by that slender muscle, the palmaris longus. And the exact location of this muscle, and the work that it performs, may be studied in the living arm and hand. Stand with the arm held horizontally forward, but with none of the muscles of the arm or hand tensed. Ascertain the exact course of the palmaris longus, as shown in the illustrations. Now, rapidly open and close the hand. While doing so let the fingers of the other hand move rapidly up and down along the indicated line of the palmaris longus. The location of that muscle will be verified as its action is felt through the skin.

Now, rest the finger tips of the right hand in the center of the palm of the left hand, closing the fingers of the left hand over the backs of the fingers of the right hand, and the movements of the muscles enclosed in the palmar fascia will be felt. This may be extended by placing the right finger tips over the inside of the first phalanges of each of the fingers of the left hand and again working these left fingers shut and open. The play of the finger muscles will thus be illustrated.

On the inner sides of the fingers the most important muscles are naturally the flexors which have to do with folding the fingers over when closing the hand. The first and fourth fingers are also supplied with active abductor muscles, which are used in drawing these fingers away from their fellows.

In the palm of the hand is an extensive system of muscles of an inferior class that are known as the *lumbricales*. They perform an important part in aiding the flexors of the fingers.

At the base of the hand, where it joins the wrist, is a strong liga-

ment known as the *annular ligament.* It forms a strong band, or ring, around the wrist, and is divided into two portions, the anterior (front) and the posterior (rear) ligament.

At the forward or finger end of the palm is another ligament known as the *superficial transverse ligament.* This is a fibrous band that stretches across the roots of the four fingers, and is closely attached to the skin in the clefts.

Both the annular and the superficial transverse ligaments aid in keeping in place the bones that they cover. They furnish protection, also, to the muscles, tendons, blood vessels and nerves that pass under them.

The most important muscles in the back of the hand are the extensors that serve to straighten the wrist, hand and fingers in line with the forearm, thus doing work exactly opposite to that performed by the flexor muscles.

The extensors of the fingers are controlled by a muscle known as the *extensor digitorum communis.* This rises in the back of the condyle of the humerus, or on the opposite side of the condyle from the palmaris longus already described.

This extensor digitorum communis, just below the middle of the back of the forearm, divides into three muscles that pass on to the first, second and third fingers, forming the extensor system there. There is a separate extensor muscle for the little finger, but it is connected with the common extensor of the other fingers.

For the thumb there are three extensors, one of these rising from the back of the shaft of the radius, and two from the back of the shaft of the ulna. One of the muscles rising from the shaft of the ulna controls the extension of the metacarpal portion of the thumb; the extensor rising from the radius connects with the first phalange of the thumb, while the other muscle that rises from the ulna is the long extensor muscle of the thumb, and controls the second or end phalange of the thumb.

We have left to examine only the extensor muscles of the wrist or carpus. The carpal extensors are the long and the short wrist extensors, both of them lying close to the thumb or radial side of the back of the forearm.

We find that the most remote muscular control of the wrist and hand comes from the lower extremity of the upper portion of the arm. In other words, the principal muscles controlling the wrist and hand rise from the condyles of the humerus. It may be added, by

way of review, that the biceps and triceps muscles of the upper arm, by means of their insertion respectively in the radius and ulna, assist in two forms of motion of the wrist. Thus the biceps helps to control the supination of the wrist and hand, while the triceps helps direct the pronation of the wrist and hand. These two movements of the wrist are of importance in a great variety of manual activities.

An observer, watching the countless movements of any normally active person's hand through a day, might conclude that the muscles of the hand had so much to do that no especial muscular training is needed for the hand. But it would be a mistake to make such a conclusion. Exercises that provide for the severe flexing and extension of the hand and fingers are of importance in every scheme of physical training. Consider, for instance, how much is implied by the use of the common expression, "a strong grip." And this grip can be strengthened greatly by exercises that provide vigorous and continued activity to the flexor muscles, the extensors receiving their share of exercise from movements as much opposed as is possible.

Weak wrists are so common as almost to be the rule. Exercises that provide for the supination and pronation of the wrist—such as movements that twist the wrist rapidly and vigorously—are indicated. Nor can the importance of the various forms of "tug" be overlooked when the muscular upbuilding of the wrist is attempted. It must be borne in mind that weakness at the wrist travesties swelling biceps. Of course, the reader must not forget, in considering the question of the strength of any set of muscles, that the muscles are only the instruments or agents through which power is expressed. The real power is in the nervous system, as we shall show later. Of course, it cannot be manifested through the muscles if they are undeveloped or otherwise incompetent. A strong grip, accordingly, while of course requiring a perfect muscular equipment, really depends upon one's nervous energy, or what people sometimes call constitutional vigor, because it is a matter that depends upon the strength of the body as a whole. We know that it depends upon the mental effort and the intensity of "mind-strength" exerted when gripping tightly with the hand. We usually find that persons capable of great mental concentration, men of exceptional nervous organization, have very good grips, at least when in a fair condition of health and even moderate muscular vigor.

Stand on one leg and raise the other until the thigh, or upper part of the leg stands out horizontally forward. Over this horizontal thigh

run one of the hands along over the front—now the upper portion, moving the thigh part slowly up and down while continuing the examination with the hand. Carry this examination along the center of the front of the upper leg from the point where it joins the trunk, at the upper end, to the knee, at the lower end of the femur.

As the leg is kept moving a little up and down the play of the muscles under the skin over which the hand is passing will be felt. And it will be seen that a compact mass of muscles covers the front of the upper leg over its whole length. Indeed, this mass of muscle will be found to extend over the sides of the femur. Near the knee this aggregation of muscle unites in a single and very strong tendon.

For convenience this great mass of muscle is treated as one muscle and is called the *quadriceps* (four-headed) *femoris.* It is the great extensor muscle of the leg, and is therefore used for straightening the leg. It is the greatest factor in the muscular work of walking or running, of cycling, of going up or down stairs, or in any movement where the leg is alternately bent and straightened.

While the quadriceps muscle is treated as one, it is divided into four muscles, each of which has its appropriate name. The four muscles composing the quadriceps are the *rectus femoris,* the *vastus lateralis,* the *vastus medialis* and the *vastus intermedius.* Each of these muscles has its own head, or point of origin.

All of these four branches of the quadriceps unite near the knee in a single tendon that is attached to the patella, or knee-cap. Thus, through contracting, is the quadriceps able to "pull" the leg straight.

The rectus femoris has its origin in the ilium, or upper ridge of the os innominatum, or hip-bone. It passes in a straight course downward over the front of the femur. It arises from the point of origin in two tendons, which unite, then spread into a mass of tendinous fibers. Farther down the muscle becomes a broad, thick mass of tendinous fibers and then unites in the common tendon of the quadriceps.

On the side of the femur is the vastus lateralis, which forms the largest part of the quadriceps. Its movements may be felt plainly, and it may be distinguished easily from the rectus femoris. On the inner side of the leg the vastus medialis will be found. The vastus intermedius, the fourth and remaining muscle of the quadriceps, appears to be a part of the vastus medialis, but in dissection it will readily separate.

A muscle of which much is heard is the *sartorius,* or "tailor's mus-

MUSCLES OF THE LEG WHEN EXTENDED

1. Rectus femoris.
2. Ileo-tibial tract.
3. Biceps femoris.
4. Patella.
5. Ligamentum patellæ.
6. Tendon of biceps femoris
7. Semimembranosus
8. Fibular collateral ligament.
9. Gastrocnemius.
10. Soleus.
11. Peroneus longus.
12. Tibialis anterior.
13. Peroneus brevis.
14. Extensor digitorum longus
15. Extensor hallucis longus.
16. Peroneus tertius.
18. Tendo calcaneus (Achilles).
19. Lateral malleolus.
20. Superior peroneal retinaculum
21. Location of subcutaneous bursa of external lateral malleolus.
22. Cruciate crural ligament adjoining transverse crural ligament.
23. Inferior peroneal retinaculum.

cle." It has received this latter name because it is much used by tailors when they sit cross-legged. This muscle has its origin in the upper part of the hip-bone; it crosses obliquely over the upper portion of the femur to the inside of the leg, descends vertically, passes behind the inner condyle of the femur, and taking the form of a tendon is attached to the upper part of the inner shaft of the tibia. It is the longest muscle in the body.

Well on the inside of the leg, and toward the back, are the adductor muscles, which are used to draw the legs together or to draw either leg inward in line with the spine. Whenever, from a position of standing with one leg well out at the side, you draw it in closer to the other leg, the adductor muscles are used, and their motions can be felt through the skin. There are three of these adductor muscles, the *adductor magnus, brevis* and *longus*. All have their origin at the crotch, and they extend obliquely to the femur. The adductor magnus is the uppermost muscle; just below it is the adductor brevis, and below that the adductor longus. The three lie together in a triangular formation that resembles somewhat the appearance of an opened fan.

At the back of the leg are found the *gluteal* muscles. There are four on each side; it is not necessary here to name them separately. These gluteal muscles are all found over the buttocks. They perform a variety of muscular work, such as abducting and extending the thigh, and also causing it to rotate outwards. The gluteals have another important function; in conjunction with certain of the back muscles they help materially in holding the body erect.

Behind the thigh-bone are the muscles that act in opposition to the quadriceps femoris. The most important of these, which serve to flex the knee, are the biceps (two-headed) *femoris,* the *semi-tendinosus* and *semi-membranosus* muscles. Of the two latter it is enough to say that they aid the biceps femoris in flexing the knee that is, causing it to bend. These three muscles are known as the "hamstrings," and their powerful tendons may be felt very plainly just above the knee at the back of the leg.

The biceps femoris is a muscle of considerable size. It is found at the back and outer edge of the thigh. The main attachment of this muscle at its insertion is to the fibula near the head, but a slip from the tendon is attached to the shaft of the tibia.

The biceps femoris extends obliquely downward to the side of the leg. Thus, when it is slightly contracted, and the knee but half flexed,

the knee will point outward—or, in other words, be rotated—and this is on account of the oblique direction that the biceps takes.

Below the knee the first muscle to consider is the *tibialis anterior.* This is the somewhat fleshy muscle that will be felt when running the finger tips down over the outer side of the tibia or shin-bone. The work of this muscle is to raise the inner edge of the foot. The origin of the muscle is at the head of the tibia; it passes vertically down over the shin-bone and passes under the annual ligament of the ankle. The muscle ends in a tendon, and its ultimate attachment of insertion is with the metatarsal bone of the great toe.

On the back of the lower leg we find the two muscles that form the calf. These muscles are known as the *gastrocnemius* and the *soleus.* The gastrocnemius is broad and forms the largest part of the calf. The soleus is a broad, flattened muscle lying directly beneath the gastrocnemius. The lower tendons—that is, the tendons of insertion—of these two muscles unite near the heel to form the strongest tendon in the body, the *tendo calcaneus* (tendon of Achilles). The size and strength of this tendon may be felt through the skin at the back of the heel.

This tendon is the strongest in the body. If it were not so it would be difficult to stand, and all but impossible to take even the most faltering steps. The tendon of Achilles is placed where it is for the purpose of keeping the body in an erect position as the weight of the body is thrown on the foot.

At a casual glance the foot does not seem to be the seat of a very extensive muscular system. We are liable to look upon the foot only as a flat-bottomed sort of affair on which to stand. Certainly the foot is not capable of as great a variety of movements as is the hand. Hence, why should there be as many muscles? Why should they be of the same importance as the muscles of the hand?

A knowledge of the muscles of the foot is not as essential as is a knowledge of the muscles of the hand. But, nevertheless, a knowledge of the muscles of the foot is of interest. We depend upon the feet for locomotion, and that is reason enough for knowing something of them.

There is a close relation between the foot muscles and the hand muscles. In the ape, which makes more nearly a similar use of hand and of foot, the similarity of muscular structure is even more pronounced.

We have found that at the wrist of the hand there is an annular

ligament that completely binds the wrist and covers and protects the tendons of muscles as they pass into the hand. At the ankle there is a similar annular ligament, with this difference: While the annular ligament of the wrist consists of two portions—the anterior and posterior—the annular ligament of the ankle is divided into three portions. The *anterior annular ligament* of the ankle passes transversely over the front of the ankle. On the outside of the ankle is the *external annular ligament,* and on the inside is the *internal annular ligament.*

Treating the ligament as a whole, it may be said that it binds down and protects the tendons of the muscles that pass under on their way to connection with the muscular system proper of the foot. And, at the same time, the blood vessels that nourish and the nerves that serve the muscles of the foot pass inside this annular ligament.

Corresponding with the palmar fascia of the hand is the plantar fascia of the sole of the foot. This plantar fascia is the densest fibrous membrane of the body. It is of great strength. This fascia is divided into a central portion extending to and along either edge of the sole and two lateral portions.

The central portion is the thickest and is attached to the os calcis, or heel bone. At the rear of the foot this fascia is narrow and thick. Farther forward it broadens and becomes much thinner. Near the forward extremity of the metatarsal bones (the bones of the flat of the foot) this fascia divides into five processes, one running to each of the five toes.

The lateral portions of this plantar fascia cover the outer and the inner edges of the foot, and do much to give shape to that member.

The external fascia partly covers the muscle known as the *abductor digiti quinti.* It is the function of this muscle, which extends from the heel bone to the little toe, to abduct the small toe—that is, to draw it away from its nearest fellow. The action of this muscle may be felt very plainly when the little toe is made to move sideways from its neighbor.

In like manner the internal lateral portion of the plantar fascia, which is very thin, covers the muscle known as the *abductor hallucis,* which is the muscle that draws the great toe away from the second toe.

The important muscle of the sole of the foot is known as the *flexor digitorum brevis.* It takes up the whole of the sole of the foot that is not occupied by the abductor muscles of the great and little toes. Near the metatarsal bones this broad muscle, which has its

origin in the os calcis, divides into four tendons, which proceed to the great toe and to the three other toes nearest it. Just where one of these tendons passes into its toe it divides into two portions, allowing beween the two portions the passage of the tendon of the flexor longus digitorum to the end of each toe.

The upper side of the foot is called the dorsum or back of the foot. When it is considered that the sole is the portion of the foot corresponding to the palm of the hand, it will be easy to understand why anatomists denote the upper side of the foot as its "back." And, as the extensor muscles of the hand are found in its back, so the extensor muscles of the foot are located on the upper side.

Corresponding to the plantar fascia of the sole is another fascia on the dorsum or upper side of the foot. This is a very thin membrane, and on the sides of the foot it blends with the lateral portions of the plantar fascia.

On the top of the foot we find the important muscle to be the *extensor digitorum brevis,* opposing the flexor of the sole. This extensor muscle has its origin in the forward, upper and outer portion of the os calcis. The muscle passes obliquely over the dorsum of the foot, and, like the flexor of the sole, it divides and passes into four tendons. Of these the largest tendon passes into the great toe, the other three tendons passing into the second, third and fourth toes, and proceeding on the outer sides of the long extensor tendons of those three toes.

The muscles of the foot rarely require special exercise. Walking, running, dancing and innumerable activities serve this purpose. The use of the feet in holding to the stirrup of the saddle, or in pressing against the foot-brace of the row-boat, are forms of exercise for the muscles of the feet.

Perhaps one of the most perfect exercises for the feet is tree climbing, bare-footed, especially small trees where the knees do not hug the trunk of the tree but where the feet are used to "walk-up" the side of it, as it were.

A great deal that is of practical value concerning the work that is performed by the muscles of the feet can be learned by resting one foot over the knee of the other leg. Move the foot in every possible direction, feeling for the muscles that supply the desired motion. The muscles may be felt through the skin, and their location is easily found.

In closing this discussion of the muscular system we may consider, briefly, the details of the general muscular scheme employed in holding the body upright.

In the leg the muscles employed for this purpose are those found at the front and back. At the upper part of the femur the work is carried on upward by the gluteal muscles over the hip. These, in turn, combine in action with certain muscles of the back, and thus the muscular connection is kept intact until the base of the skull is reached.

On the front of the body there is a slight break in the muscular connection at the head of the thigh, but just past this brief interval the work is taken up once more by the vertical abdominal muscles, and there is another break in the direct muscular connection when the sternum is reached. Beyond, however, strong muscles at the front of the neck carry the work upward to the head. It requires the cooperation of all these muscles in the front and at the back in order to make man different from the lower animals in that he is able to stand and to walk in an upright position.

With a general knowledge of all the important muscles of the body, their location, structure and actions, we should be able to devise appropriate exercises for their healthful employment, at least where they are not sufficiently used in the everyday activities of life to keep them in the best condition. We know that if our muscles are not used they will atrophy and lose their powers, and, furthermore, with such inaction all of the other functions of the body will stagnate, and, eventually, result in a weakened physique or even in abnormal and diseased conditions.

Without muscular activity the circulation becomes sluggish, the functions of assimilation and nutrition are impaired and the entire human system loses tone and vigor. Later on we shall take up the subject of exercise for detailed and thorough treatment, offering exercises of every suitable kind for every part of the body, not only to strengthen the muscles themselves, but for curative effects and for increasing the store of dynamic or nerve-energy of the body. As we have said, we can accomplish innumerable results in improving the welfare of the body by the use of the voluntary muscular system, this being perfectly within the control of the will.

The benefit of exercise to the involuntary muscles comes from the fact that the free use of the voluntary muscles forces the involuntary muscles to greater activity through greater demands upon the respiratory, circulating and digestive organs and vessels. Thus, exercise is of direct and instant value to the health, activity and strength of all of the general organs. These, in turn, through their greater and purer activity in eliminating waste and in supplying nutriment, return incal-

culable benefit to all of the voluntary muscles by building them up with fresher material.

The Spinal Cord and the Nerves.—If one were given the privilege of making a study of only one part of the body to the exclusion of all others, supposing that it were possible to study any one part independent of its relationships, then the student of health would do well to concentrate his attention upon the nerves and the great nerve centers.

The longer and the more thoroughly we study the structure and functions of the human body, the more clear and absolute becomes the conviction that the secret of human strength and energy lies in the nervous system, the great central office represented by the spinal cord and brain serving as a store house, as it were, for the dynamic energy which is expressed through all of the tissues and organs of the human system.

At the very best, life is an unfathomable mystery, one which neither we nor anyone else can hope to solve. We cannot presume to say just what this mysterious force of life is. We may call it nerve-force or vitality, or whatever we choose. We do not know just what it is, but we do know that it exists and there can no longer be any reasonable doubt that it is centered in the nervous system. Although this is not clearly understood by the general public, yet one might think that it was partially recognized in colloquial terminology by the very common use of the expression, "nervous energy." When we speak of a person who seems to be tireless, possessed of a fund of working power that seems almost without limit, we make comment upon his having an unusual amount of "nervous energy." What do we mean by that? It appears to be almost an instinctive or intuitive appreciation of the fact that strength and energy are not resident in the muscles or other tissues of the body, but in the nervous system.

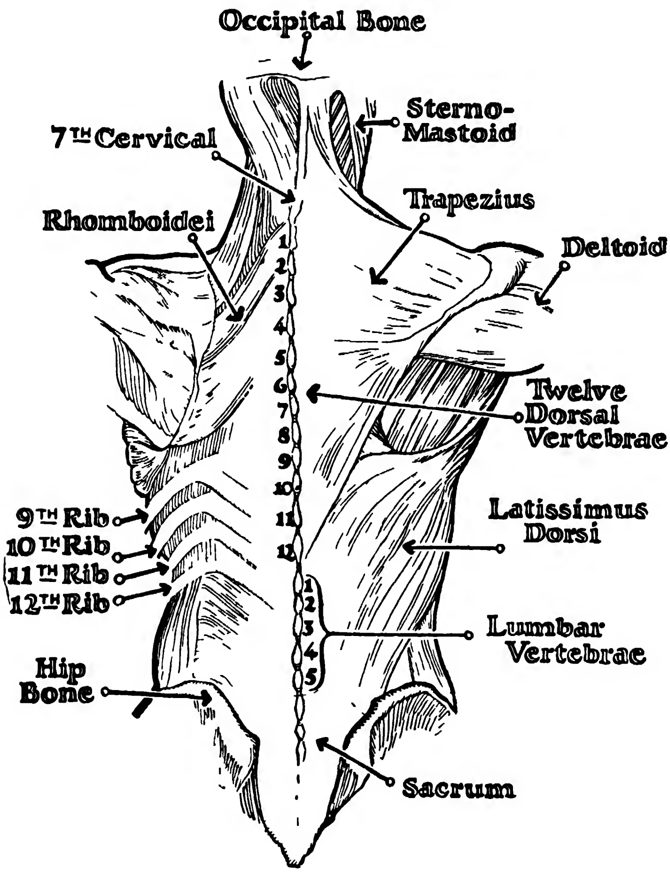
An interesting fact, confirming the truth of such conclusions, is found in the peculiarities of athletic success. One might otherwise expect that sheer bulk of muscle would predominate, but, on the contrary, we have continuously noted that the victor in most athletic contests is not so much a man of remarkable muscular bulk as of exceptional nervous strength. The nervous temperament, so-called, when properly balanced and supported by a normal and vigorous bodily development, makes the successful athlete. Who has not seen a man with spindling legs and apparently slight, wiry muscles outrun an entire field of more heavily muscled men, both in short dashes and in distance runs? Such

a man is usually capable of an exceptional degree of speed and endurance. And who has not occasionally seen a man of a hundred and forty pounds accomplish some feat of strength that others weighing two hundred pounds could not duplicate? And among athletes of the same weight and apparent muscular development, who has not seen one so far outstrip the others in strength, endurance and general muscular efficiency that he seemed to be in a different class? What is the reason? Muscular development? No. There are differences in the muscular fiber and quality of different individuals, but not to the extent of accounting for the remarkable variations in strength. The secret of these differences lies in their respective nervous systems and in the amount of energy stored up there. This will also explain, in a way, the variations in the strength of the same individual noted on different occasions, even though his muscles are of the same bulk and apparent condition. At one time he will have a greater amount of energy or nerve-force stored away in his brain and spine than at another.

Mental concentration in muscular effort is another fact which should indicate the source of energy. Everyone knows that it is the man who can get his mind into his effort who can accomplish the most in a lift or a feat of strength. Those who are accustomed to athletic endeavors will understand this very readily, from their own consciousness of the sensations of extreme muscular effort. Did you ever try, for instance, to exert yourself to your full strength in the effort to accomplish some difficult piece of work, and then find that you would have to do even more than that, and have you then gathered together all your forces, as it were, and made a second attempt in which you knew that you would have to do a definite proportion more, and in which you actually did do that much better, in order successfully to accomplish your purpose? If you have ever done this you will recall that the effort was largely a mental effort, that you entered into the final attempt with what you would call an inflexible determination or power of will, and that by this means you succeeded. But this expression of will-power, or mental determination, should show very clearly the nature of the power that did the work. Indeed, you can almost "feel" that this is true when you exert yourself, if you are alert and conscious of your sensations at the time. You realize that it is a matter of mental application and nerve-force; that you do it *by putting your mind into your muscles.*

It has been thought that energy is generated in the muscles, but we

know that the muscles are powerless to act without the impulses from the nerves. We know that heat is generated in the process of muscular action, but it would appear from study of the subject that this is probably incidental rather than the cause of the manifestation of energy known as muscular strength. We also know that waste matter is consumed by chemical union with oxygen, forming carbon dioxide, or carbonic acid gas, as it is more popularly known, among other things, this combustion producing heat. It would appear, also, that the break-



The number of muscles in the back and of the posterior of the neck is over fifty. Those of the back are in five layers. The illustration above shows outer layers with their attachment to bony structures. It can be observed from this illustration how the movement of any part of the trunk produces a muscular effect upon the spine.

ing down of muscular tissue which gives rise to this waste matter is only incidental rather than the cause of the expression of energy. As already said, we know that the muscles do not and cannot act of themselves, but only through the nerve impulses transmitted from the brain, and we can scarcely avoid the conclusion that the actual power which operates in these tissues is the energy which comes from the spine and brain, which serves as a storage battery, and which, when partly exhausted, is regained through the building up and revitalizing processes of sleep.

We may compare the organic and muscular system of the body to an engine, the agency through which power is expressed, while the power itself is the expanding force of steam or the explosive energy of gasoline. Or, we may compare the body to a collection of perfectly constructed electrical motors, these being incapable of anything in themselves, but marvelously efficient when supplied with energy.

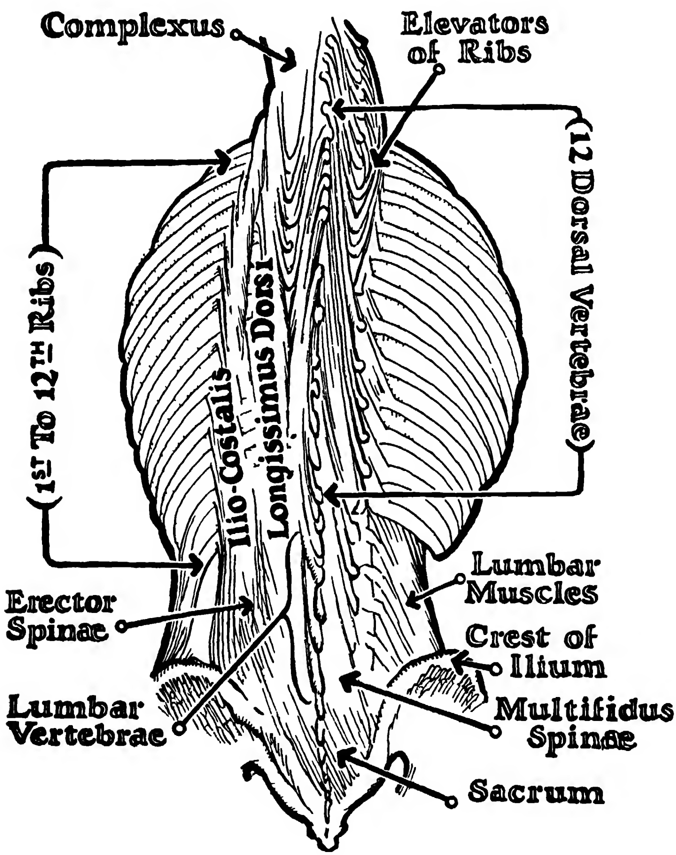
Rest of the brain and nervous system, as will be apparent at once, is a matter of vital and utter necessity, whereas we know from the constant beating of the heart and the uninterrupted action of the muscles involved in respiration, that there need be no such complete rest for the muscular tissues. It is because the actual source of energy and power is to be found in the brain and spine that we require the unconsciousness and rest of sleep. It is true that a certain degree of nerve force is expended even in sleep, in continuing the action of the heart and respiratory muscles, but this is insignificant compared with the phenomenal outlays of energy known during the waking hours.

Now that we have stressed the importance of the intricate mechanism of the brain and nervous system, the vital and dominating factor of human life, we will consider its remarkable anatomical structure.

It consists of two kinds of nerve tissue—first, gray matter or nerve cells, and second, white matter, composed of nerve fibers and end-organs. In the gray matter or nerve cells is the central source of nerve energy, the white nerve fibers are the wires over which this is sent, while the end-organs are specialized apparatus for the immediate transmitting or receiving of impulse for motion or sensation.

The whole nervous system of the body may be compared to a telephone system; the gray matter, the central offices; the white matter, the wires; and the end-organs, the local telephones. The gray matter or central offices, like a telephone system, has one great

exchange and many smaller ones. The great central exchange is known as the brain, while the smaller ones are such as are found along the spinal cord, and many other parts of the body, in the form of small lumps of gray matter called ganglia In the white matter—the nerve fibers or wires—we have the same simile carried out, for we find single fibers or wires going to certain end organs or local phones, as well as large cables or bunches of wires passing along through the body, giving off here and there one or more wires; the greatest example of which is the spinal cord.



This drawing is a partial representation of the two inner layers of back muscles. The outer layers shown in the preceding illustration are chiefly concerned with giving strength to the back, the inner ones with rotating and keeping erect the spine and the head.

In our discussion of the nervous system, we will take up, first, the separate divisions of this great human telephone system.

The Brain.—First and foremost in this description comes the brain, filling the interior of the skull. It is easily divided for purposes of description into three parts: the cerebrum, or fore-brain, the cerebellum, or hind-brain, and the medulla or connecting link between the above two parts and the spinal cord, or great cable. The cerebrum, or fore-brain, occupies all that portion of the skull situated forward and above the openings of the ear. It is held in place by a stout white fibrous membrane, which encloses it in a firm, elastic case by which it is attached to various places in the interior of the skull. It rests upon the floor of the skull from the forehead as far back as the rear of the ears, and thence to the back of the skull it is supported by a strong, fibrous membrane which is known under the name of the roof of the cerebellum. This membrane separates the fore-brain from the hind-brain. These are also sometimes called the "upper-brain" and "lower-brain."

The cerebrum or fore-brain is roughly of the shape of half a walnut kernel, its average weight being forty-nine ounces, in man, while the brain of the average woman weighs five ounces less. It is soft, easily torn, and is held together for the most part by a very fine network of elastic fiber which permeates all its parts. The gray matter or nerve cells of this part of the brain is found in a layer of about one-quarter of an inch in thickness all over its surface. This surface is not smooth, but is thrown into multitudes of tiny hills and valleys, a good deal like the markings on the surface of the walnut kernel previously mentioned. This formation serves the purpose of making a larger extent of surface than if the exterior were smooth.

The rest of the fore-brain, or the inner portion of it, is composed of white nerve fibers which connect not only this brain with the hind-brain or cerebellum, but also with the spinal cord, and also each portion of the cerebrum with every other portion thereof. The cerebrum is divided by a large fissure, running from the front backward, into two equal parts, lying one on each side of the cavity of the skull; these are called hemispheres. Between these two hemispheres we have a band of white nerve fibers, running transversely, which connects the two sides of the cerebrum together. This band is known under the name of the "hard body" (*corpus callosum*). There are bands of white nerve passing from one portion of each side of the cerebrum to other portions of the same side, and also running downward from

each half of the cerebrum in the form of a cable which afterwards divides into two cables, one connecting with the hind-brain, the other with the medulla. These cables are known as the *legs of the cerebrum.* In each half of the cerebrum there is a large irregular space known as a *ventricle,* which is more or less filled with fluid known as *cerebro-spinal fluid.* This forms a water cushion, and is for the purpose of taking up any and all shocks which may come to the brain, and of making them harmless to that tissue.

The gray matter, or nerve cells of the cerebrum, are definitely localized in their working abilities or powers. In other words, there are points in various portions of the brain which are invariably the surface of the centers of the production, either of impulses, the reception of sensation, or the conceptions of special sense. Let us consider the location of these centers in a general way.

The region of the surface of each half of the cerebrum situated immediately above and a little behind the ear contains the centers of action for voluntary motion of muscles of the face, limbs, and trunk of the body. Here an interesting fact should be noticed, that is, that the centers of the left side in this region govern the voluntary motion of the left side of the face and that of the limbs and trunk of the right side of the body. Those on the right side of the brain in the same region control the right side of the face and the left side of the body. The gray matter covering those ends of the two halves of the forebrain situated behind the forehead is the localized center of the intellectual faculties, while the gray matter covering the rear ends of these two halves contains the following nerve centers: First, that controlling vision or eyesight; second, the original center for speech; third, the primary nerve origin of the sense of smell, and the function of reasoning known as memory. The special nerve center for the sense of hearing is behind each ear.

When one remembers the description of the multitude of nerve fibers connecting the various portions of this brain with each other, one may conceive the means by which harmony and equilibrium of the workings of both sides of the body and the mutual activity of the double organs of special sense are accomplished.

The Cerebellum, or Hind-Brain, is situated in the lower rear portion of the skull, below the posterior half of the cerebrum or forebrain. It is separated from the latter by a strong partition of fibrous material, extending from the back of the skull to the middle of its base. Lying, as the partition does, horizontally, it forms the rear part

of the floor which supports the cerebrum, constituting at the same time the roof of the cerebellum.

The hind-brain, like the fore-brain, is divided into two hemispheres or lateral halves, and these are connected by transverse bundles of nerve fibers with each other. Besides this connection, each half of the cerebellum is connected in a similar manner with the hemisphere of the cerebrum on the same side above, and with the medulla below. Resembling the cerebrum, the hind-brain is formed with the gray matter or nerve cells on the outside thrown into folds or convolutions which, however, are not so numerous nor so deep as those of the fore-brain. The nerve fibers (or white material) are situated in the interior of the cerebellum and give the appearance, on section, of a tree trunk with leafless branches. This has been called in Latin, the *arbor vitæ* ("Tree of Life"). This mass of nerve fibers is made up of radiating fibers from those connections between the cerebellum and other parts previously mentioned. In the cerebellum there are no ventricles or water cushions as have been described as occurring in the cerebrum.

In this hind-brain are located the centers of voluntary motion of a peculiar order. Here we find the source of that energy which causes the control of movements which are especially concerned in progression and the maintenance of equilibrium. This control is somewhat sub-voluntary in its action, as only the start in walking is consciously voluntary. The same is true of equilibrium or muscular harmony. Besides these functions, the cerebellum acts as a sort of a relay or way station for impulses going in both directions.

The Medulla is the connecting link between the brain and spinal cord, and is really a modified portion of the latter. This is often called the medulla oblongata, because of its form. The medulla differs from the spinal cord mainly in its shape and in the fact that it contains a set of higher class nerve centers. It is situated below and in front of the cerebellum. It is about two inches in length and is really the juncture of the brain and the spinal cord at the base of the skull.

In the medulla and the Pons Variolii, a structure situated at the base of the brain, are located, among others, eight important nerve centers, controlling cardiac, vaso-motor, and inspiratory activities; mastication, articulate speech, glycogenic, salivary, and swallowing processes.

All parts of the brain, as previously described, are supported, protected and suspended in their place and divided from each other by a dense, white fibrous membrane, known as the *dura mater.* The brain

tissue is so soft, that without such support it would simply fall apart. Enclosed as it is in the bony cavity of the skull, it needs to be supported in such a manner as to be protected from sudden jars and shocks. The bony skull itself is built in such a manner and of such material, that only under exceptional violence does it fail to prevent injurious jarring or direct injury to the brain tissue. Immediately beneath and closely applied to the dura mater is a delicate membrane, the *arachnoidea.* Underlying the arachnoidea we find a sac-like membrane resembling in its formation the pleura (which covers the lungs) and carrying a vast net-work of blood-vessels which penetrate to all portions of the brain and nourish its tissue. This membranous sac is called the *pia mater* and invests the brain in all its parts with a double layer. The opposing surfaces of these layers are smooth, shiny and covered with a lubricating secretion, for the purpose of allowing free, frictionless movement of the brain in all directions. On the under surface of the brain may be seen the various nerves of special sense making their exit from its substance. Under the fore-part of the cerebrum, beginning in front, one sees first the two olfactory bulbs from which arise about twenty nerves of smell on each side. These latter penetrate the floor of the skull going straight downward to be distributed to the membrane which lines the upper cavity. Next in order comes the optic nerve, that of the sense of sight, arising directly behind the orbits and proceeding through orifices in the skull, one to each orbit, to be distributed to the eye. The nerve last mentioned has a peculiarity not noticed in the other nerves of special sense, in that before entering the orbits, the fibers mix together so that in each optic nerve we have fibers from both sides of the brain running to each eye, thus producing harmonious action between the two eyes.

The Spinal Cord is the cylindrical, elongated part of the cerebro-spinal system, which is contained in the spinal column or back-bone. It extends from the base of the skull, where it connects with the brain, through the medulla, to the upper border of the small of the back, where it terminates in a number of nerve fibers which pass down the balance of the spinal canal, below the termination of the spinal cord. These nerves are so disposed as to resemble in appearance the tail of a horse and are called in the Latin language, the *cauda equina* or "horse's tail." The length of the spinal cord proper is usually about sixteen or seventeen inches, its weight being about one ounce and one-half. It does not nearly fill the canal in the back-bone in which

THE CENTRAL NERVOUS SYSTEM

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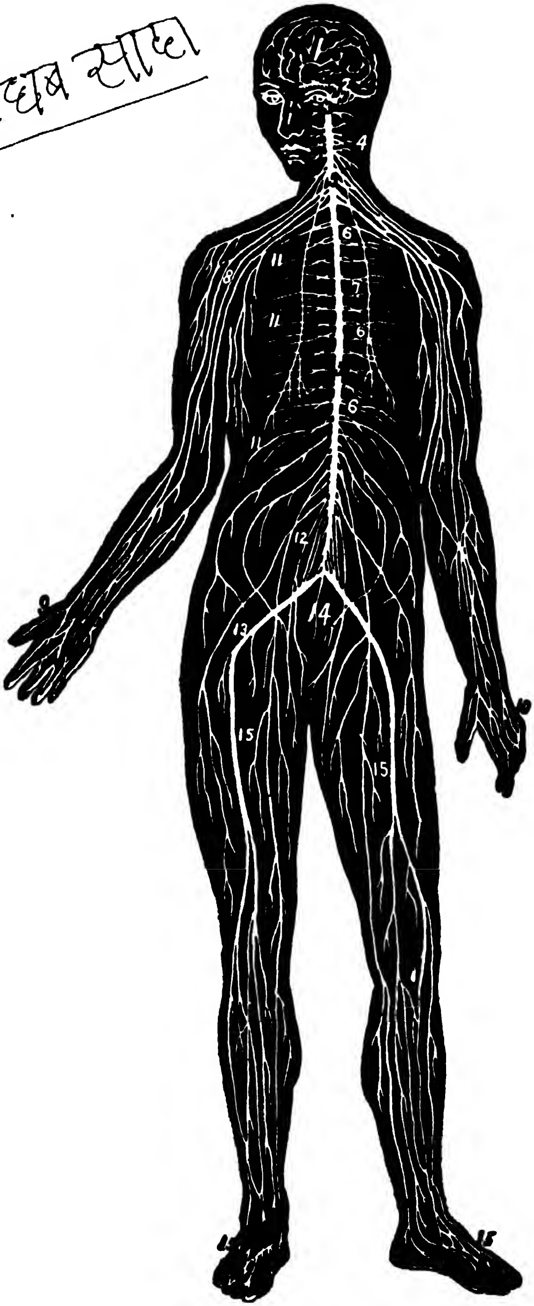
The central nervous system, including the spinal cord and brain, is shown in this diagram as it appears in the human body when viewed from the front.

1. Cerebrum.
2. Cerebellum.
3. Medulla oblongata.
4. Cervical or neck nerves.
5. Spinal cord.
6. Thoracic nerves.
7. Phrenic nerve (to diaphragm).
8. Brachial plexus.
9. Palmar nerves.
10. Nerves of the back of the hand.
11. Intercostal nerves.
12. Sacral plexus.
13. Sciatic nerve.
14. Terminal filament.
15. Nerves of the thigh, leg and foot.



it is located, but is surrounded and separated from the bony walls of this canal by a supporting and protecting membrane (similar to that surrounding the brain), loose connective tissue and a net-work of veins.

The shape of the spinal cord varies considerably, according to the part of the back-bone which it occupies. In the region of the neck, the diameter of the cord is greater from side to side than from front to back, and all its diameters are greater in this region than elsewhere. At the middle of the back of the chest all the diameters of the cord are smaller than anywhere else in its length, and are about equal to each other. Below the chest the cord again widens from side to side, but although larger in every way than in the chest region it is much smaller than in the neck.

The material of which the spinal cord is constructed is exactly the same as that which constitutes the brain. However, in this region of the spinal cord, the component parts are arranged in exactly the opposite way to that in which they are put together in the brain. In the cord, the white material or nerve fibers, instead of being in the inside as in the brain, composes the outer portion of the cord, while the gray matter is located in the center, never appearing on the surface, and only to be seen on cross sections of the cord. When a transverse cut is made of this organ, the gray matter appears in the center, disposed roughly in the shape of a butterfly, the tips of the wings barely touching the circumference of the cord. The amount of gray matter in proportion to the white varies greatly in different parts of the cord.

On examining the surface of the spinal cord, one finds on its anterior portion a fissure running the whole length of the cord, up and down. This fissure is just deep enough to barely reach the gray matter of the cord. In the middle of the posterior surface, one may see another longitudinal fissure, also extending the whole length, but deeper than the anterior one. These two fissures divide the cord into two lateral halves which are connected to each other by the gray matter. The gray matter of the cord, like the gray matter of the brain, is a mass of nerve centers for the origin or reception of nervous impulses. Reverting to the simile made use of in previous statements on this subject, these nerve centers in the cord may be compared to local telephone exchanges.

The white matter of the cord consists of bundles of nerve fibers running up and down this organ. These bundles may be divided into

three classes, this depending on the work they do, namely, those which are continuous fibers from the brain through the cord and out again to some organ of the body; those which start from some nerve center of the gray matter of the cord and run upward or downward to some other nerve center of the cord or brain; and those which, originating in some nerve center of the cord, pass downward and outward to some tissue of the body. Again, these nerve fibers of the cord may be divided into two classes in regard to the character of the nerve impulse which they carry, namely, first, motor nerves, which carry impulses for motion from the cord to the tissues of the body; second, sensory nerves, which carry impulses of sensation from the tissues of the body to the cord.

As the spinal cord passes down the length of the canal in the back-bone, it gives off bundles of nerve fibers which pass out from this canal through openings in the side walls of the bony cavity. These are like local telephone cables, leaving the local exchanges to spread their wires through the country. They are technically called Spinal Nerves and each one arises by two roots or bundles from the side of the spinal cord. These roots are on the same level but placed one behind the other. The one in front is called the anterior root and carries nerve fibers for the transmission of motor impulses only. The one towards the rear is called the posterior root and carries fibers for the transmission of sensory impulses only. These two bundles of nerve fibers or roots, shortly after emerging from the cord, mingle their fibers with one bundle called a spinal nerve. All along the course of the cord, these spinal nerves arise and issue in pairs, one (by two roots) on each side of the cord. There are thirty-one pairs of spinal nerves.

After their emergence from the back-bone, numbers of these spinal nerves on each side mingle their fibers together on the same side, and again split up into bundles of nerve fibers which are distributed to every part and tissue of the body. This commingling of the nerve fibers just described is called a nerve plexus, and these plexi are given specific names according to the region of the spinal column near which they are located.

After a nerve reaches a tissue for which it is destined, it splits up into its separate fibers and each one of these proceeds to the special piece of tissue which it is intended to serve. Here, at its final end, there is a specialization of the nerve fiber, called an "end-organ," which may be compared to the terminus of a telephone line. This end-organ is

so specially constituted in each and every portion of the human anatomy as to be capable of doing one and only one of the following special pieces of work: First, it may be intended to communicate energy of motion to a muscular fiber; second, to receive sensations of feeling or pain; third, to recognize sensations of special sense, such as light, heat, sound, smell and taste.

All of the nerves proceeding from the brain and from the spinal cord exist in pairs, one nerve of each pair proceeding on either side of the body.

These thirty-one pairs of spinal nerves are divided, according to location, as follows:

Eight upper spinal or cervical nerves, twelve dorsal, five lumbar, five sacral and one coccygeal. You will, of course, remember about the cervical, dorsal and lumbar divisions of the bony spinal column and also the nature and location of the sacrum and the coccyx.

Of the cranial nerves, which proceed from the brain, there are twelve pairs, classified as follows:

First pair.—The olfactory nerves, ending in branches throughout the lining of the nose. These nerves are sensory, and report to the brain the impressions of odor.

Second pair.—*Optic* nerves; sensory; these inform the brain what the eyes see.

Third, fourth and sixth pairs.—Motor nerves that control the movements of the muscles of the eye..

Fifth pair.—Each nerve of this pair divides into three branches. Hence this is called the *Trigeminus,* or tri-facial nerve. First branch, sensory, giving sensibility to the eyeball. Second branch imparts sensibility to nose, gums and cheeks. Third branch, partly sensory and partly motor, controls sensation on front part of tongue, on inner side of cheek, on the teeth and on the scalp in front of the ear, also the special sensation of taste.

Seventh pair.—The *facial* nerves, motor, spread their branches over the muscles of the face and control their movements.

Eighth pair.—*Auditory* nerves, sensory, are the nerves used in hearing.

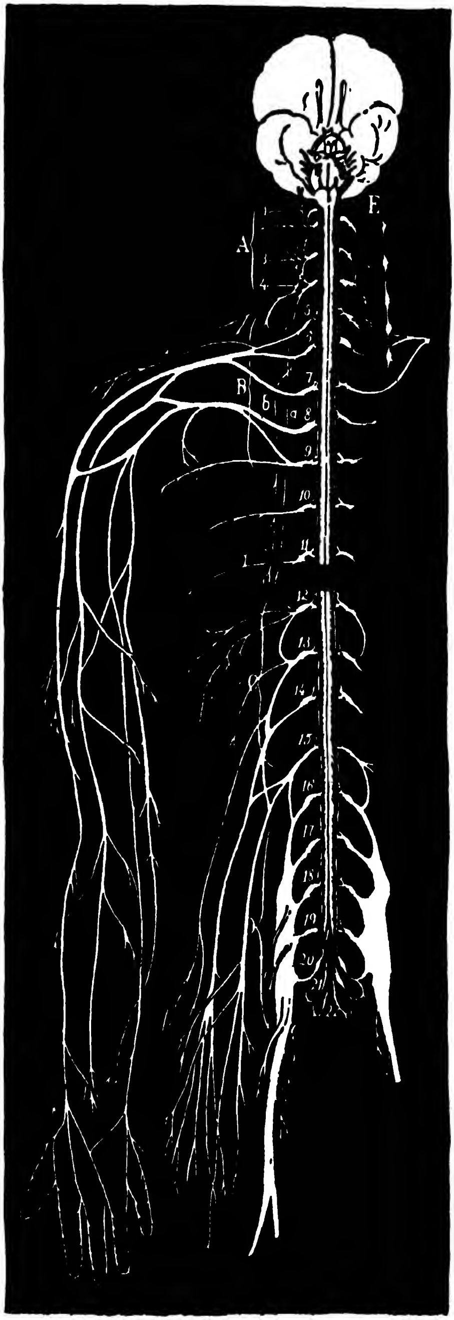
The ninth, tenth and eleventh pairs of nerves all have their origin in the medulla oblongata.

Ninth pair.—The *Glossopharyngeal.* Two branches; one, sensory, spreads over back part of tongue, controlling taste at that point; other branch, motor, directs the swallowing muscles.

SPINAL CORD AND CENTRAL NERVOUS SYSTEM

This diagram shows the arrangement of the spinal cord and important branches of the central nervous system.

A. Cervical or Neck Nerves.
B. Thoracic Nerves.
C. Lumbar Nerves.
D. Sacral Nerves.
E. Form of Connection with the Sympathetic System.
1 to 4. First to fourth cervicals.
5 to 9. Brachial plexus.
10. Second dorsal.
11. Third dorsal.
a and b. Phrenic nerves.
12 to 16. First to fifth lumbar.
17 to 22. First to sixth sacral.



Tenth pair.—The *Pneumogastric* nerves, motor and sensory. Pass to the stomach, sending off branches to heart, lungs, larynx and throat. One of the most important nerves in the body.

Eleventh pair.—The *Accessory* nerves; motor. Control muscles of neck and back.

Twelfth pair.—The *Hypoglossal* nerves. Extend to muscles of tongue and direct them in the movements of speech.

Before proceeding further with the study of the spinal nerves it is necessary to define a "plexus." This may be a network either of nerves or of veins. In this chapter a nerve plexus is meant.

Of the cervical nerves the four upper pairs interlace to form the cervical plexus. From this plexus motor nerves are sent to the nearby muscles; sensory nerves are distributed to the skin of the back of the head, of the outer ear, neck and the top of the chest and shoulders. A branch of this plexus, the phrenic nerve, passes down to the pericardium of the heart, and sends motor nerves to the diaphragm. The four lower cervical nerves form the brachial plexus, which sends sensory branches to the shoulder, the upper part of the chest and the skin of the arm, and motor branches to the muscles of the shoulder, arm and hand. Branches of this plexus are the median nerve and the ulnar nerve, which supply the sense of touch to the fingers and hand.

The first dorsal nerve is a part of the brachial plexus, and it supplies sense and motion also to the first intercostal muscle. The eleven other dorsal nerves are also intercostal nerves, and they communicate, as well with the sympathetic system and with the muscles of the walls of the chest and those of the sides and front of the abdomen.

The four upper lumbar nerves comprise the lumbar plexus. Its branches go to the muscles and skin of the lower front of the abdomen, of the hip, outer side of thigh, hip and knee-joints and outer border of leg and foot. The last lumbar and four upper sacral nerves combine to form the sacral plexus, which sends motor nerves to the gluteal muscles, which, as you remember, are those of the hips, and to those of the back of the thigh, leg and foot. From this same plexus come sensory nerves for the skin at the back of the hip and thigh, for the front, outer side and back of the leg, and as well for the back and sole of the foot.

The Sympathetic Nervous System of the body, although as widely distributed as the cerebro-spinal system, or even more so, is infinitely less generally understood even by scientific men.

For ages it was to be the source of the sympathetic workings of

the internal organs of the body, and the seat of human feelings or passions, hence its name. This statement, however, is no more true of the sympathetic system than of the cerebro-spinal.

The sympathetic system, so-called, consists of two parts: First, ganglia, which are small masses of nerve cells, gray in color; and, second, nerve fibers, also gray in color.

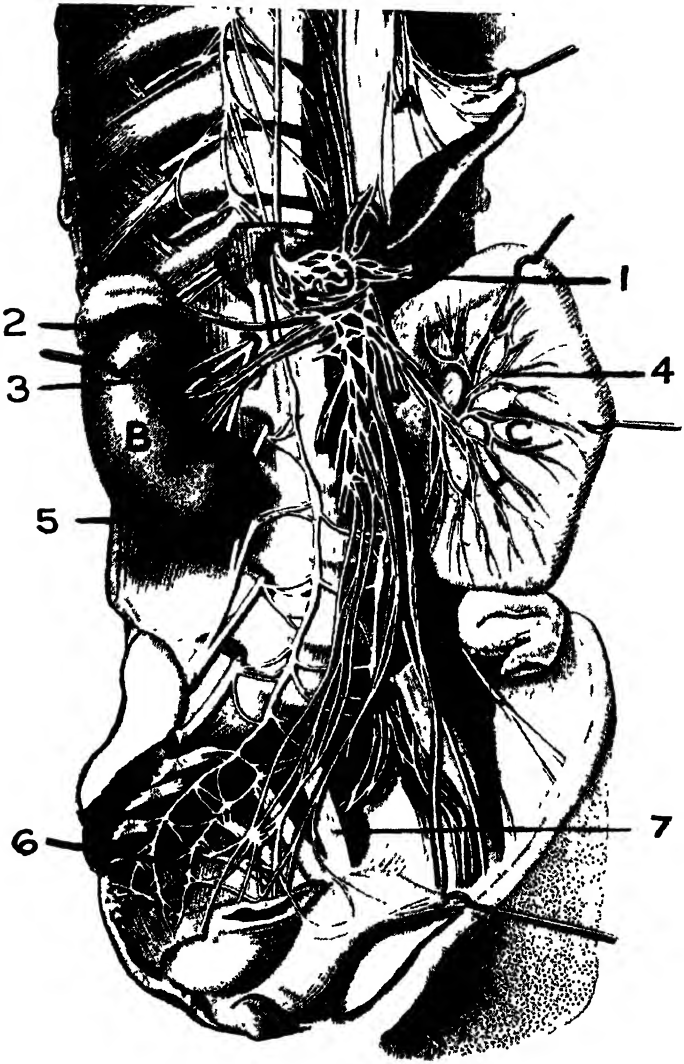
The main or central sets of ganglia are situated symmetrically on each side of the spinal column, within the cavities of the body. They are not as numerous as the spinal vertebræ, and are situated as follows: In the head there are four on each side, and one additional single one; in the region of the neck there are three pairs; in the dorsal or chest region, twelve on each side; in the lumbar region or loins, there are four pairs, and in the pelvis there are five on each side and one single one.

These ganglia, or masses of gray cells, are connected with each other not only up and down in the body, but across in front of the spinal column. In other words, each ganglion is not only connected by a nerve with the next one above it and the one immediately below it, but also with its fellow of the opposite side. Thus we see that all these ganglia, which are located in pairs along the sides of the spinal column, from the brain to the lower tip of the spine —from the single one at the top, which is situated directly at the under surface of the brain, to the single one on the pelvis directly in front of the tip of the spine—are connected with each other in every conceivable way.

Besides those ganglia already mentioned there is a subsidiary series of similar ganglia situated in the cavities of the body, being generally placed near or upon some one of the greater blood vessels.

Still further, there are large numbers of still smaller ganglia, yet more secondary in character, scattered all over the body in the various tissues. They are found in the heart, in the liver, in the spleen, in the kidneys, in the lungs, in the brain, between the voluntary muscles under the skin, close to the secreting glands of the body, between the coats of the stomach and intestines, and in and about the walls of all the blood vessels. In fact there is no definite specialized tissue of the whole body which has not more or less of this ganglionic tissue situated somewhere in or about it. Thus it may be seen that the entire body is abundantly provided in every nook and corner with more or less of these gray, sympathetic nerve cells.

These ganglionic masses act in exactly the same way as does the gray



This illustration shows the distribution of the principal sympathetic nerves and plexi within the abdominal cavity.

A. Cardiac end of stomach (rest of stomach removed)
B. Kidney
C. Small intestine and mesentery
1. Gastric sympathetic plexus
2. Solar plexus
3. Lumbar plexus (upper part)
4. Mesenteric plexus
5. Lumbar plexus (lower part)
6. Sacral plexus
7. Pelvic plexus

matter of the brain and spinal cord. That is, they are originating or receptive centers of more or less ability. From the central or spinal column ganglia first described, nerve fibers originate and pass outward, to enter, after ramifying into a mazy network of connecting fibers, into one of the primary subsidiary ganglia. From thence, fibers again pass out, ramify, re-collect and enter the secondary subsidiary ganglia in the organs.

From this third set of ganglia, fibers finally pass to various tissues of the organs of the body, such as the involuntary muscular fibers of the heart, the muscular fibers which control the motion of the stomach and intestines, the plain muscular fibers in the skin whose contractions cause the appearance known as goose-flesh; the tiny muscles in the pupil of the eye (the activity of which changes the size of the pupil), or the tiny muscles in the walls of the blood vessels, the function of which is to increase or decrease the size of these vessels. They also pass to the cells of such organs as the liver, spleen, kidneys, salivary glands, sweat glands, etc., whose work it is to secrete certain materials used in the chemistry of the body.

Now that we have looked for a few moments at the superficial anatomy of this great part of the nervous system, let us try to obtain a good general view of its purpose: In the first place, the sympathetic system controls and energizes all the muscular power of the body which is involuntary in action. In other words, it is the source of the nerve power of all those muscular activities of the body which so rhythmically and untiringly manifest themselves without the aid of will power. It keeps the heart in action, and, with the assistance of the cranial nerve known as the pneumogastric, regulates and controls that action. It is the source of the muscular activity of the stomach, intestines and other similar organs which, at stated times and under certain forms of stimulus, carry out their duty. It is largely by the nerve force of the sympathetic system, that the closing and opening of the gates of the bladder and rectum are controlled. By its force the quantity of light allowed to enter the eye is regulated. Through its nerve energy, the tension of the blood current in the whole body or in any local part is increased or diminished. By means of this system, the salivary, gastric and other glands pour forth their digestive fluids at the proper time.

Besides these functions of muscular, nutritive and controlling power previously mentioned, the sympathetic portion of the nervous system is a means to the reception and conveyance to the brain of peculiar sensory impressions. It is by this means that sensations of temperature,

such as heat and cold, are given to the mind. Through it, also, is conveyed that peculiar form of sensation which is known as muscular sense. For example, the impressions of pressure, hardness, softness, etc., are obtained in this manner. Impressions of pain in the internal organs of the body are carried to the mind in this way. Through this channel, also, we probably obtain knowledge of more or less distant presence of bodies.

In the treatment of the subject it will be noticed that we are directing our attention chiefly to the spinal cord, rather than to the upper brain. This is because we have every reason to believe that in the matter of vitality and physical energy, the spinal cord and the medulla are of special importance, that, indeed, the real energy of the body, that which we call the essential force of life, is centered there. The cerebrum, on the other hand, is rather the organ of thought, the seat of intellect. In creatures of great intelligence the cerebrum is large and well developed, whereas in those of low intelligence it is small and undeveloped, and all irrespective of the strength and vitality of the animal. The life-force or vital strength does not seem to have much to do with the development of the cerebrum.

In the brain of the gorilla, essentially the same in structure as that of man, the cerebrum is very small and undeveloped, but there is no denying the nerve-force resident in that powerful spine, or the tremendous physical energy of which this brute nether-man is capable. The same will apply to all the lower animals, down to the almost brainless but much vertebrated snake.

Exercise and Nervous Energy.—In developing the muscles around the nerve centers, more healthful action and greater vigor of these parts is secured. More nervous energy is stored away, and then, as one might say, one has more life or vim, but one really has a larger supply of nervous energy, that can be used as needed by the voluntary or involuntary muscles of the body. When you increase the supply of nervous energy, the internal organism is not only strengthened (that is, the tissues forming the walls thickened and increased in vigor) but it has a larger supply of nervous energy to draw upon when needed.

Let us take the stomach, for example, one of the most important of all the internal organs. The influence of the spinal invigoration, advocated here, upon the stomach is in the nature of a strong tonic that has no bad after-effects. The food eaten is thoroughly mixed and exposed to the action of the digestive juices by the muscular efforts of the stomach. As you can well realize the digestion of the food depends to

a very large extent upon the strength of these muscles. The strength of the muscles is secured almost entirely from the nervous or electrical force that has been stored away for use by the functional system. In proof of this, if you should exercise so hard by running or walking such a great distance as to entirely exhaust yourself, your appetite for food would disappear entirely, or if you had a desire to eat anything, it would be an abnormal craving, for the stomach, in such circumstances, is not able to digest food. Food would simply have to lie there undigested until sufficient nervous force had accumulated to make the stomach properly perform its functional process. Of course, a moderate amount of exercise would increase your appetite, for then the system would be calling for more nourishment, and there would be enough nervous energy to digest whatever food you might eat; but when the exercise is continued beyond fatigue to exhaustion, as previously stated, then there should be no appetite, for food could not be digested under such circumstances.

The stomach, therefore, is strengthened by securing an additional supply of nervous energy. The digestive juices that flow into the stomach from the various glands also depend upon nervous energy for their activity. These glands require nervous impulse, just as does the stomach, in order to carry out their work properly, and the strength and quantity of the digestive juices, of course, very materially affect digestion and the general processes of caring for the food while in the stomach.

Functional vigor is really a part of health. Health means a harmonious working of all the functional processes. A high degree of functional vigor naturally insures a satisfactory supply of blood. It insures proper elimination. The poison that is always present even in the healthiest body is eliminated through the various depurating organs existing for that purpose. A high degree of functional vigor insures the proper performance of this important office. The body is then properly nourished, it is kept clean and purified, and is consequently strong in all parts. This is absolutely necessary, as one can well realize in developing and maintaining health.

If you do not possess health of the highest degree, then you may be suffering from some disease. If you do not possess the gift of abounding health that we have tried to describe, then there is something wrong. But no matter what your complaint may be, a large amount of nervous energy is absolutely essential in order to bring about a definite and permanent cure. We must also realize that

the failure of the body to properly maintain a high degree of health, is nearly always due to functional difficulties brought about through improper diet, muscular inactivity, dissipation, and various other evils that are found everywhere in this age, these evils themselves largely the result of insufficient nerve-energy.

Now in curing an ailment of any kind, the functional system must, of course, be set right. It must be made to work harmoniously, and the vastly increased amount of nervous energy that can be secured and actually stored up by the body from the following up of the methods we are advocating will cause every organ of the body to work more smoothly and harmoniously, and disease of any nature will slowly but surely begin to disappear. Vital vigor is at the highest point when through constant efforts you have been able to develop the degree of muscular and vital strength necessary to actually force the body into a proper performance of its duties. Then you will probably find that your ailment, whatever its nature may be, has entirely disappeared.

Disease, regardless of its nature, in nearly all cases indicates vital depletion. The vitality is lowered below the normal. The supply of nervous energy has been materially lessened, or else the nerve centers through some difficulty are not able to properly supply the required energy. All these results are caused in most cases by what we term vital depletion, and this lack of vitality or lack of nervous energy can be satisfactorily remedied in practically every instance by adhering to the methods we advocate in these volumes in a general way, and especially by giving attention to the methods of spinal invigoration which we are offering and the practical application of which will be taken up in detail in another volume.

It is usually quite a problem for the average manual laborer as to whether or not he can be benefited by taking additional exercise of any kind, and as those who are in the habit of using the muscles all day are frequently tired out at night and exercise of most any kind seems an irksome task, you can hardly blame manual workers for questioning the value of additional exercise. The ordinary occupations of manual workers require the use of only a part of the muscular system. These few muscles are, of course, in many instances, overworked, while other muscles of the body are used but very little. Where this is continued year after year, the result is that the body is pulled into various shapes which are far from those it should assume to maintain proper proportions. We would, therefore, say

to the manual worker, learn something of your body. Learn its anatomical structure and its muscular needs, and those muscles that are not being used daily in your work should be given a certain amount of vigorous use at frequent intervals.

We would hardly advise a manual worker who goes home completely tired out, to take up additional exercises at that particular time when he cannot enjoy them, but at some other time when he is not so tired and he feels he has a certain amount of reserve energy, the active and thorough use of those muscles that are not brought into play during the day at his regular work will be of very great benefit. We have seen this demonstrated in a large number of cases.

If the muscles all around the spinal column are strengthened and thoroughly developed in every way, they will not only increase one's general vital vigor, but those in the habit of doing hard manual labor will find that their general strength will be very greatly enhanced, because they will then have more nervous energy to be used in their labors. Where the occupation requires a certain amount of lifting, of course, the muscles at the small of the back will not need to be given very much attention, but the muscles at the back of the neck and between the shoulders should be given regular exercise. Not only that, but all the various exercises that are inclined to lengthen the spinal column, and to push the vertebrae together, will be found a very great stimulant to the muscular and vital organism.

The brain worker requires nervous energy. He can hardly secure too much power of this kind. The more vim and vitality one possesses, the more life and spirit one can put into his brain work. Continuous brain work is said to be the hardest kind of labor, and the statement is undoubtedly true where the work is continued for protracted periods or where one works long hours each day. The efforts of the brain, however, depend very largely upon the physical efficiency, upon the possession of a high degree of nervous energy, and because of this, there is nothing that we know of that will so stimulate the vital energies of the brain worker as exercises affecting the seat of the nervous powers. They almost directly affect the brain itself. Accelerating the circulation through the entire spinal column very materially enhances the healthfulness of this particular organ, and at the same time encourages the nerve centers in their efforts towards storing up a large amount of nervous energy.

Mental power depends upon nervous vigor. A brainy man is always a man in the possession of a high degree of nervous energy.

In some instances he may be phlegmatic from a physical viewpoint; at the same time, in order to possess more than usual brain power he must have back of it a strong nervous foundation. He must be full of nervous energy. Though in a general way the truth of these statements is realized by brain workers everywhere, it has never been impressed upon them sufficiently to make them understand the necessity of trying to increase their supply of nervous energy. These methods advocated provide a powerful means of stimulating the mental energy, and anything that stimulates the mental energy, gives one an increase of general intelligence. He has more brain power to work with, and he has more nervous energy that can be converted into brain power.

Because life is represented by circulation, movement, it can readily be seen that the more perfect the circulation, the more life one would possess. Death always occurs where there is stagnation. For instance, if the blood were stagnant in any part of the body, and was not allowed to circulate, that part would quickly die and would actually drop off of the body. Tie a string around any of your fingers so tightly that the blood cannot circulate therein. The finger will soon turn black and will finally drop off, except, perhaps, the bone. But an increased amount of nervous energy insures more thorough circulation. It insures an acceleration of the activity of all the functions that have to do with the circulation of the blood.

Internal Secretion Glands.—In recent years, there has been a broadening of viewpoint in regard to certain glands of the body, including the pituitary, pineal, thymus, thyroid, adrenals, spleen, pancreas, prostate and gonads. These glands, often called ductless glands, are now known to yield secretions which enter into the blood stream not by direct means, but by absorption through intervening membranes.

The importance of the secretions (called internal secretions), of these glands is now generally recognized. The study of this subject is called *endocrinology,* and internal secretion treatment is called organotherapy. More and more the healing professions turn to this system of treatment to normalize the chemical balance of the body—without which balance, as we have long known, there can be no health.

The experiences of a large number of capable and conscientious investigators have shown that all the organs of internal secretion are

extremely closely associated and interrelated functionally, so that whenever one is disturbed there must be a more or less profound disturbance in others. This indicates the close interrelationship between all parts of the body, and the futility of attempting to treat the body other than as a whole.

It is this very close relationship that saves us from utter physical annihilation, and that within a short time. For influences are constantly at work to unbalance some part of the body, particularly some gland producing an internal secretion. If the other glands were not called into action by the change in the one secretion, the change would be felt immediately by the body as a whole. But the change in secretion, made manifest to the other glands through the blood plasma and the sympathetic nervous system, brings about a response of these other glands and, to some extent, they with their secretions combat the change, the body being thereby apparently restored to balance. But if the alteration in the first gland continues for a considerable time or is very marked, then even the combating glands are altered in function more or less permanently. A man cannot be normal or healthy when his chemical balance is disturbed, whether this disturbance is produced by gland derangement, wrong dietetic habits, drugs, alcohol, or what not.

The *thyroïd* gland, which is located in the front part of the neck, has been called "the keystone of the endocrine system," as it is vitally important as a controller of metabolism—the tearing-down and building-up processes of the body tissues. Growth is also largely governed by it. The thyroid has, when normal, a stimulating effect upon the sexual organs, but it is likewise stimulated by these organs. In the adult we have the condition of myxedema, and in childhood cretinism (see p. 1693) which result from *deficient* thyroid secretion. Cretinism and myxedema are similar to the condition resulting from removal of the thyroid gland by surgery. Exophthalmic goiter, or Graves' or Basedow's disease (see p. 1918) is due to an *excess* of thyroid secretion. Other common symptoms of deficient thyroid activity in comparatively normal individuals are falling of the hair, dry and wrinkled skin, lowered temperature, lessened perspiration, slow digestion and consequent loss of weight or reduced metabolism and resulting obesity, reduction of mental power and activity of the nervous system, skin disorders such as hives, itching and herpès (shingles) migraine, asthma, chilliness, enlarged breasts, etc.

The *adrenal* (also called the suprarenal) glands are small glands, one above each kidney. Their importance to the system can scarcely be overestimated. Their secretion is supposed to help maintain the oxidation within the tissues. One of the functions of the adrenal secretion is to combat toxicity when there is infection. The fever during these infections is thought to be due to the excessive oxidation which the increased secretion produces. Other functions of the secretions are to maintain normal tone of the nerves, including the vasomoter nerves, and of the entire musculature of the body, especially of the heart and blood vessels (involuntary muscles). When it is *excessive,* we have high blood pressure, headaches with threatened apoplexy, violent or at least greatly increased force of the heart action, flushed face, mental acceleration, etc. When it is *deficient,* as frequently follows the overstimulation of the adrenals in combating infections like influenza, typhoid, pneumonia, and other prolonged fevers, following surgical anesthesia, in alcoholism, etc., one is listless, subject to neurasthenia, with low blood pressure, lack of ability to stand either physical or mental exertion, vague aches and pains, especially lumbar pains, etc.; in fact, every function of the body is reduced. Slow convalescence is frequently the result of adrenal depression. Sudden severe injury, great loss of blood, severe psychic shock, and acute acidosis bring about acute prostration of the adrenals, as they are called upon suddenly for a greater supply of bracing secretion than they can supply. Some deaths taking place on the operating table, supposedly due to "surgical shock" or from the anesthesia, may be due to an acute reduction or suspension of adrenal function. We may see, then, that the adrenals have a most decided effect on establishing or maintaining a normal condition of every part of the body.

The *pituitary* gland, located within the skull, is divided into two sections, the anterior and posterior. The action of the anterior portion is somewhat similar to that of the thyroid, and yet it has work entirely different from that of the thyroid.

To some extent the posterior part does work similar to that done by the adrenals. It is known to have a very marked effect upon the heart and other involuntary muscles, and kidney secretion. Giantism or acromegaly results where the anterior lobe is especially involved in a manner to greatly *increase* its secretion, while growth and maturity are delayed or retarded permanently where there is a *lessened* amount of its secretion. In cretinism and myxedema the pituitary is involved, along with the thyroid. Epilepsy is frequently brought about or aggra-

vated by disturbances of the pituitary. Neurasthenia depends in some cases, apparently, upon defective secretion of the anterior part of this gland, and where this part supplies less than a normal amount of its secretion there are apt to be menstrual disturbances, sterility, and easy exhaustion. In certain extreme abnormalities of action of this gland we have arrest of sexual development, obesity, continual desire to sleep, erratic heart action, "smothering" sensations, profuse perspiration, extreme irritability, and one form of diabetes.

The *gonads* are the ovaries in women and the testicles in men. Formerly they were thought to be strictly reproductive glands, but they are now known to have an internal secretion that is of the greatest value to the organism. They have a repressing effect upon the thymus gland, a gland of the growth period. It is these glands which, in a large measure, are responsible for the change in secondary sexual characteristics—in the youth the change to a deeper voice, the growth of hair on the body, the broader frame, heavier muscles, and the desire for association with the opposite sex; in the girl, the development of the breasts, the beginning of the menstrual phenomena, and also a desire to associate with the opposite sex.

These glands have much to do with mental activity, also with general body metabolism. This latter effect is noted in the marked tendency of a woman to gain weight after the change of life, for after this time the ovaries have ceased functioning and the body is minus their secretion.

In the period of pregnancy, the breasts, not retarded by the secretion of the ovaries, undergo enlargement and begin the change necessary for their secretion of milk. Where the ovaries are undeveloped or *decreased* in function for some reason, we have infantilism, menstrual irregularities, smothering sensations, palpitation, headaches, neurasthenia, fatigueability, irritability, hysterical crises, anxiety, loss or absence of sexual desire (frigidity), low blood pressure, etc. Where there is excessive ovarian secretion we have precocious puberty, copious menstruation, increased sexual instinct, large pelvis, firm, fairly small breasts, well rounded lower limbs with proportionately smaller upper body, desire for movement and action, and erotic crises. Insufficiency of testicular secretion results in absence of secondary sexual characteristics, lessened supply of hair, tendency to obesity, long lower limbs, small head, childishness, frigidity, impotence, sterility, fatigueability, etc.

The *thymus* gland is a small gland prominent in infancy and child-

hood. It lies in the upper chest, extending from the lower border of the thyroid to the membranous bag enclosing the heart. It was long thought to have little function after the age of two, and to disappear completely shortly after puberty. But it has been found to persist well up in life, though it does undergo a fatty change at about the time of puberty.

This gland has a vastly important rôle to play in the development of the child during its intra-uterine life and for the first years of extra-uterine life. Marasmic babies who have died have been found to have the thymus gland greatly atrophied. It is thought to have a restraining effect upon the sexual apparatus, preventing in some measure a precocious sexual development. Where the secretion of this gland is *deficient* there is reduced hemoglobin with lessened body heat and a tendency to rickets. *Excessive* secretion causes profuse sweating, heart palpitation, an excess of red blood corpuscles and hemoglobin, headache and weakness.

The *pineal* gland is the second small gland within the skull. Experimental work has shown that its removal or lessened activity results in sexual precocity, indicating a restraining effect upon the gonads. In cases of tumor of the gland there are metabolic and nutritional changes, such as obesity and an abnormal enlargement of the sexual organs and the breasts.

The *pancreas,* we know, pours into the duodenum during digestion an "external secretion," which contains substances for the digestion of all classes of food. But this gland also supplies a most valuable internal secretion; it is a disturbance of certain small areas in the body of this gland, called islands of Langerhans, that is responsible for most cases of diabetes. The secretion of these minute islands is responsible, to a considerable extent, for the oxidation of sugar.

Among other symptoms resulting from pancreatic disturbances are skin affections, such as dry skin, boils, itching, and reduced perspiration; dry mouth, neuralgia, atrophy or diminished activity of the testicles, headache, tendency to fatigue, susceptibility to cold, perforating ulcers of the foot, apoplectiform attacks, paralyses, dizziness, false angina, depression and coma.

The *parathyroid* glands are minute glands, from two to four in number, situated within the substance of the thyroid or thymus gland or sometimes outside of either of these glands. It is known that these glands are glands of internal secretion, and that their functions are different from those of either the thyroid or the thymus. Their secre-

tion is thought to have in some way an important part in the development of paralysis agitans, epilepsy, chorea or St. Vitus' dance, and exophthalmic goiter. When they are removed (in certain animals during experimentation) there is a development of tetany, as a result of disturbed metabolism of calcium, increased ammonia in the blood, increased nervous excitability, and acidosis. In eclampsia, that severe condition of convulsions during the pregnant state, these glands are disturbed.

The *spleen* was long thought to have little other function than the making of red blood cells; then it was supposed to have some action in the disintegration of these same cells and of the white blood cells, apparently after they had served their use in the body. But this gland is now believed to have an important internal secretion that stimulates the stomach and the intestines in the secretion of digestive fluids, also the musculature of the intestines, thus increasing peristalsis. This gland has something to do with the digestion and assimilation of food, for in cases where the gland has been removed or seriously affected the appetite is increased and more food is consumed, and yet there is no gain in weight and there may even be a slow and gradual loss of flesh. The iron content of the blood is reduced where the spleen is lessened in activity, and the gland is thus involved in the development of many cases of anemia. Defective spleen action is thought to cause or aggravate cancer and tuberculosis. This organ is frequently enlarged in infections, indicating that it is one of the active fortifications of defense against infection; typhoid fever and malaria are two diseases in which this enlargement is especially noticed.

The *mammæ,* or breasts, are usually considered as having but the one function of secreting milk for the nourishment of the young. But the results of experiments seem to indicate that they yield a fairly strong secretion that has a controlling effect upon the uterus and ovaries. In cases of fibroid tumors with bleeding, where the menstrual periods come with too great frequency and severity, and in the oozing of the menopause, they have found that stimulation of the breasts to greater secretion will check the loss of blood and, in cases of frequent menstruation, reestablish normal rhythm of the periods.

The *prostate* gland is a male gland located around the outlet of the bladder. It has quite recently been assumed to have an internal secretion, as well as its external secretion. It is certain that this gland

is very much disturbed in certain cases of neurasthenia and melancholia. Where it is lessened in activity there is lowered blood pressure, loss of strength, lessened potency, and not infrequently suicidal tendency or even suicide. Where the gland is enlarged there is high or increased blood pressure, slower heart action, tendency to cerebral hemorrhages, and genital excitation.

The *liver,* as we know, produces bile—a combination of secretion and excretion—necessary in digestion and as an eliminator of waste materials from the body; but there is thought to be an internal secretion also. Where the liver is inactive there is a much greater tendency to hemorrhage—nose bleed, bleeding from the lungs and stomach, mucous membranes, and into the skin, etc., and in hemophilia or "bleeder's disease"; also skin disorders, diabetes, and certain intoxications arising within the intestinal tract. It is thought that this internal secretion of the liver has a stimulating effect upon the secretion of bile itself.

While the pancreas is known to be responsible for the majority of cases of diabetes, there are other cases in which the liver is at fault. Deficient hepatic secretion is supposed to be responsible for some few other conditions, one of which is that painful affliction, gout.

There are still other organs which are thought to yield important internal secretions, among which are the *stomach, duodenum,* and *intestines.* In these cases the secretions are presumably activators of other glands of digestion, apparently no less important for the welfare of the body, however, than some of the ones that have been discussed more fully.

The Organs of Digestion.—The human digestive system, upon close study, reveals itself as a marvelously efficient and competent mechanism, considering the work which it accomplishes. Its wonders are much like those of other parts of the body; the more we study and observe them, the more remarkable do they seem. Consider the functions of the digestive organs in their relation to the rest of the body, how they labor faithfully day after day, month after month and year after year, often under a handicap of persistent, unstinted abuse, in order that the other organs and tissues of the body may be supplied with new material with which to reconstruct themselves, new fuel to keep alive and aflame the glowing spark of life.

In the very lowest forms of life the entire animal is practically nothing else than a stomach, after its kind, or, more accurately, a mass of jelly-like cells which have the power of assimilating organic matter

that it may come in contact with, except when it is itself digested by some larger creature. But in man the stomach is a highly specialized organ, acting as a part of a complex and perfect whole, and performing the work of digestion for all of the other organs, just as they in turn perform their respective services for the stomach and the other parts of the body. It will be seen that the modern industrial plan of "division of labor" was worked out by Mother Nature infinite ages ago, and much more perfectly than we have been able to learn it in the labors of human society. In speaking of the stomach, here, we should have referred to the entire digestive system, including not only the alimentary canal but also the supplementary organs, the salivary glands, the liver and the pancreas.

Turning to our food before it is eaten, the wheat and the walnut, the pea and the potato, the asparagus and the apple, and the other varieties of food, just see what a change must be wrought before all these can be made over into the marvelous living human tissues that we have mentioned. And yet it is just this wonderful thing that our digestive organs accomplish, converting these various commonplace vegetable growths into the fine building material which is sent to every remote part of the body, and from which is made up the very blood, bone and sinew of ourselves.

If men and women can day after day abuse their assimilative organs by eating indigestible dishes, and still remain alive, or half-alive, then how might they not improve and perfect their health and increase their vitality by following out the intentions of Nature in regard to the use of wholesome and strengthening foods. A very large part of the disease and weakness which we find almost universally throughout the world is the result of ignorance in regard to the needs of the stomach and the dietetic dissipations and errors which arise from this ignorance. To avoid any waste of vitality, and to raise the standard of health and physical condition to the very highest possible, one should have a general knowledge of his digestive organs, their location, their action and physiological requirements. By knowing these things, he will understand that there is something out of order almost before there is anything wrong, and he will know just what to do to set it right.

We find that the organs involved in the work of digestion are many and elaborate. The digestive machinery is made up of the alimentary canal and the organs directly connected with it. From a physiologist's standpoint, the canal consists of the mouth, pharynx,

esophagus, stomach and intestines. The supplementary organs are the salivary glands, liver and the pancreas.

A detailed study of the anatomy of the mouth is hardly necessary here. We may say briefly that it is divided into three parts, the vestibule, which is the part in front of the teeth, enclosed by lips and cheeks, the mouth proper, and the back of the mouth. The study of the teeth may be left to specialists, with the advice that they be frequently examined to see that they are not in bad condition. They should be kept scrupulously clean, and we should not forget that they were intended for a purpose and should be used for that purpose, not only for their own welfare but for our general bodily welfare. If the teeth are used vigorously, and if the body is properly supplied with the food elements required to build bones and teeth, in short, if one's circulation is active, his blood pure and his condition sound in every way, his teeth will keep in good condition, except where decay has commenced.

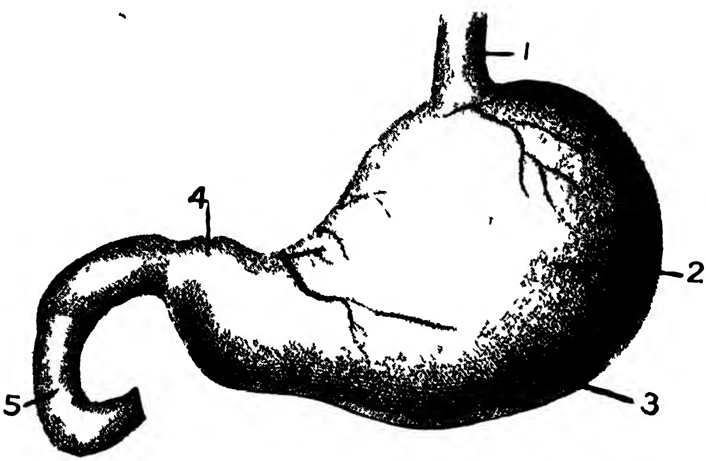
The mouth proper contains the *tongue,* forming the floor of the cavity, and consisting chiefly of striated muscle-fibers. It is one of the most remarkable of our muscular organs, and will be considered further in the discussion of the sense of taste, among the other organs of special sense. The tongue is also the chief and indispensable organ of speech. The *palate* forms the roof of the mouth, the anterior, bony part being known as the hard palate, and the posterior, movable part the soft palate. At the posterior edge of the *soft palate* is a conspicuous elongation, hanging down like an inverted cone, called the *uvula,* which is of little or no importance. The act of swallowing, by raising the soft palate, completely closes up the uppermost part of the pharynx and the nasal cavity.

From the standpoint of the function of digestion, the three salivary glands on each side of the mouth are the most important features of this cavity, acting in connection with the work of the teeth in crushing and grinding food. These glands secrete the saliva, which pours into the mouth freely when food is introduced, its purpose being to lubricate the mouth, to moisten the food, but especially to bring into solution the starchy ingredients of the food and to convert them into a form of sugar, known as maltose. The largest salivary gland on each side is the flat, triangular *parotid* gland, placed just in front and below the ear, its excretory duct empting into the mouth just opposite the last molar tooth. The *submaxillary* gland is placed just within the angle of the lower jaw and the *sublingual* glands lie upon

the forward floor of the mouth, just under the tongue, as the derivation of their name would signify. Saliva is a colorless, odorless, tasteless fluid, and it is the ingredient known as ptyalin which acts upon the starches.

The upper part of the pharynx is exclusively a part of the system of respiration, but the middle and lower parts act also as a passageway for food After its treatment with the saliva, the food passes through the back of the mouth, through the pharynx, and thence into the *esophagus,* or gullet, a cylindrical tube some nine inches long, through which the food is forced by involuntary, peristaltic muscular action, into the stomach.

There are two openings to the stomach, the first known as the cardiac opening, close to the heart; the other, the *pyloric* opening, which is at the farther end of the stomach. The illustrations will give the reader an excellent idea, not only of the location of these openings, but of the organ in general. The food enters the stomach at the cardiac, and leaves by the pyloric opening. There are four coats to the stomach. The outer one is called the peritoneal, or serous, coat, a thin, smooth membrane which also lines the abdomen; the second coat consists of three layers of involuntary muscles; the third coat,



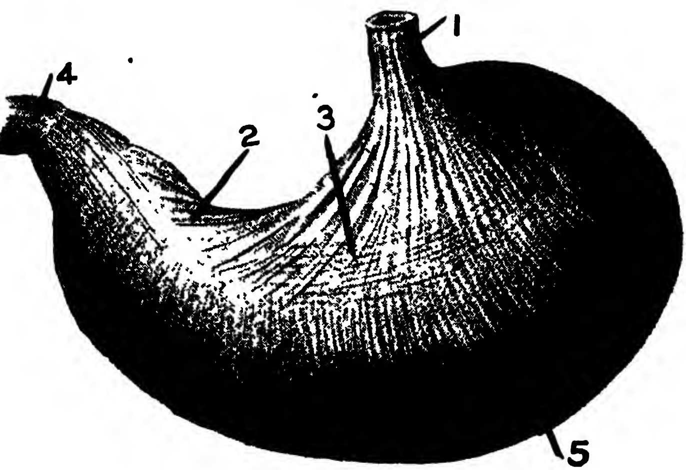
This drawing shows the external surface of the stomach, with important sections numbered.

1. Esophagus
2. Anterior wall of the stomach
3. Greater curvature of the stomach
4. Pyloric end of the stomach
5. Duodenum

known as the *submucous,* binds the fourth coat, called the *mucous,* to the muscular coat.

Now, when the stomach is empty, the mucous coat lies in folds. When the organ is dilated with food or water, the coat gradually unfolds. In it are a myriad of tiny glands, between each of which is a net-work of microscopic blood vessels. When the stomach is empty, the mucous coat is nearly colorless, but when food enters it blood rushes to all the little vessels and the coat takes on a rosy appearance. This added blood sets the glands—gastric glands they are called—in action. They open and tiny drops of gastric fluid trickle out, mix with the food and aid in the process of digestion. It should be said here that when food enters the stomach, both the cardiac and pyloric openings close automatically.

The muscular coat of the stomach begins to contract and relax, and by repetition of the movement sets up a sort of churning that thoroughly mixes the gastric juice with the food. Gastric juice contains two ferments, *pepsin* and *rennin.* Pepsin, in the presence of an acid (there is ⅕ per cent. free hydrochloric acid in the gastric juice) dissolves all of the proteid elements in the food. All foods that contain nitrogen are proteids. Nitrogenous foods, in some forms, are



This is a diagrammatic representation of the second or muscular coat of the stomach.

1. Esophagus
2. Lesser curvature of the stomach
3. Anterior wall of the stomach
4. Beginning of duodenum
5. Greater curvature of the stomach

absolutely essential to life. Meats, nuts, eggs, peas and beans are familiar samples of nitrogenous foods.

The gastric juice has no action on starchy foods; in the case of fats it dissolves the albumen in the walls of fat and sets the fat itself free in tiny particles. When completely churned and mixed with gastric juice the food contents of the stomach soon becomes a thick liquid of grayish color, and is called *chyme.* The action of rennet, the other ferment in gastric juice, is to cause milk to curdle—a process that must take place before the milk is ready for assimilation into the system. Within an hour after the food has entered the stomach, some of it is in a condition to be received into the blood. This is done by a very curious process. When in the body liquids of different densities have the power of exchanging particles through the thin walls or membranes of vessels. Thus from the various compounds ingested, the blood vessels of the stomach are able to take up or absorb such particles as the different salts and sugars.

In return for this the blood vessels expand and allow more blood to flow to the muscles of the stomach, which renews the churning process with greater activity, thus increasing the efficiency of the gastric processes of digestion. In about an hour or so after the food has entered the stomach, the pylorus opens and by the contraction of its ring-like muscles, forces waste matter and such portions of the food as are still unassimilated or undigested into the small intestine, so-called because it is approximately only an inch in diameter. In the small intestine, the process of digestion is continued in an involved and complex manner.

The small intestines are twenty-five feet in length and for descriptive purposes may be divided into three parts, the duodenum, the jejunum and ileum.

The *duodenum* is about nine inches long and starts from the pyloric end of the stomach, running obliquely backward and upward to the under surface of the liver. From thence it proceeds downward on the anterior surface of the right kidney, turning again horizontally to the left and across the lower portion of the spinal column.

The *jejunum* is the continuation of the duodenum. It is pinkish in hue and its walls are thicker than the following portion.

The *ileum,* or final portion of the small intestine, is smaller in diameter, finer in texture and paler in color than the foregoing. It ends in the cecum, the first part of the large intestine, by means of the ileo-cecal valve. This valve is situated at this place for the purpose

of preventing the backward flow of material from the large into the small intestine.

As in the stomach, the intestines, large and small, are composed of four coats, the outer or peritoneal, the muscular, the sub-mucous, and the mucous or inner lining.

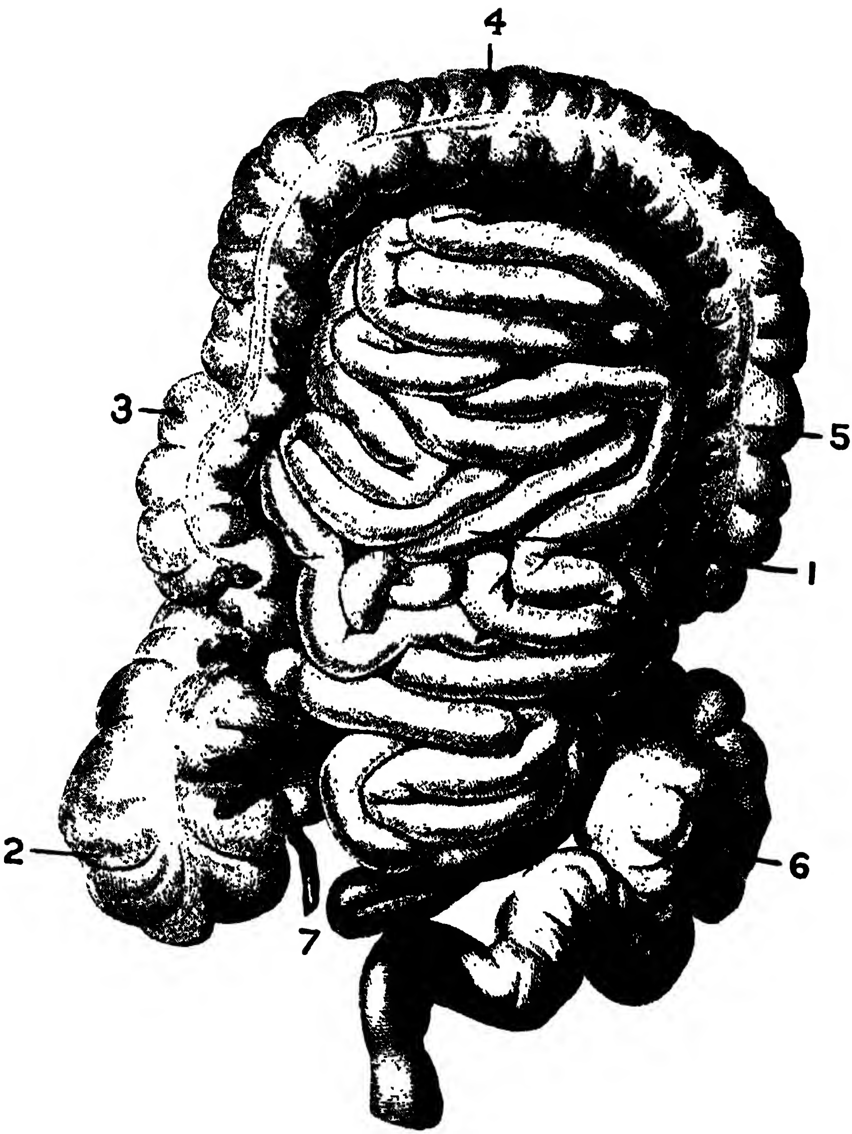
This inner or mucous lining is of very much larger extent than the others and hence is thrown into folds, or valves, giving a very much increased surface. Immediately below this mucous lining we find an immense number of small glands called *villi*. These *villi* are composed of a network of vascular tissue surrounding a central space called the lacteal.

The large intestine is five feet in length, and is also divided into three parts, the cecum, colon and rectum. The *cecum*, or first portion of the large intestine, is so-called because it is a blind pouch. It is situated in the right pelvic region, beginning at the right haunch bone. From the lower and inner side of this organ extends a small wormlike process about two or three inches in length, called the *vermiform appendix*.

Little is known of the real purpose of the vermiform appendix. The opinion has been expressed that it is something in the nature of an oil sac, containing a lubricant for the colon, but this is doubtful, especially since such lubricants are supplied from other sources. In case of inflammation in this region, the usual practice is to operate and remove the appendix.

Continuous with the cecum, we have the colon. This is divided into three portions, the *ascending* portion proceeding upward from the cecum to the under surface of the liver. Here, bending to the left, it becomes the transverse colon, crossing under the liver and stomach to the region of the spleen. Bending downward again it becomes the descending colon, until it reaches the left haunch bone. Here, becoming "S" shaped, it is called the sigmoid flexure. This ends in the rectum or the final reservoir, the outlet of which is called the anus, and which is guarded by a sphincter, or surrounding muscle. This muscle is continuously contracted, opening only at certain periods for the discharge of the stored up excrementitious material from the rectum.

The process of digestion which is accomplished in the small intestine is by far the greatest part of the whole process and is very complex in nature. The chyme, which comes from the stomach through the pyloric valve, consists of macerated food, a small portion of the



Drawing showing intestinal tract.

1. Small intestine
2. Cecum
3. Ascending colon
4. Transverse colon
5. Descending colon
6. Sigmoid flexure
7. Appendix vermiformis

albuminous material contained in the food having been partly digested in the stomach.

All the starches, sugars, fats and undigested albuminous material now come in contact with three digestive fluids. These are the pancreatic juice, bile and the intestinal juices.

The bile has a number of functions. First, it is antiseptic; in other words, it keeps the food in this warm, moist intestine sweet while being digested; second, it causes the peristaltic or vermiform motion of the intestine; third, it emulsifies the fats; and, fourth, a portion of the bile is reabsorbed to aid in the chemical changes produced in the liver tissue.

The pancreatic juice has three ferments. The first, known as trypsin, acts upon albumens, changing them into soluble albumens, or peptones, fit for absorption. The second is amylopsin, which by its action converts starches into sugars. The third is steapsin, which changes the fats into fatty acids and glycerin.

The intestinal juices have their action almost wholly upon the albuminoid material. This material, after reaching the small intestine in a digested form, is now ready for absorption. This process is carried on by the *villi,* as previously explained. The emulsified and changed fats are absorbed by means of the lacteals, the central vessels of each of the *villi.* From these they are gathered together and brought into the thoracic duct, which empties its contents into the large veins at the root of the left side of the neck. Thence this fatty material enters the blood stream and becomes food for the tissues, the same as protein or starch. The detritus, or the material which fails of digestion, passes on through the rest of the small intestine, becoming more solidified as it passes through the large intestine, finally being deposited in the rectum, which, at stated periods, evacuates its contents.

The liver is the largest gland in the body. It is so-called because it secretes, that is, produces a certain fluid necessary for the vital processes of the body. In normal human beings, it weighs about four and a half pounds. It is brown in color, sometimes stained yellow by the bile. It is divided roughly into four lobes or parts—two large and two small. It is situated on the right side, immediately under the diaphragm or muscular partition between the chest and the abdominal cavity, being protected by the free border of the lower ribs at the right side and back. It has a double blood supply, rather different in character from that of any other organ of the body. This

is because of the fact that all the blood from the intestines, into which has been absorbed the food made soluble by digestion, needs to be carried to the liver to have these absorbed foods changed. Hence, there is a blood supply known by the name of portal, and another blood supply similar to that of other organs, for the nourishment of the liver itself brought by the hepatic artery.

The work done by this organ is of various characters: First, it produces or secretes what we know as the bile, which we referred to briefly a few moments ago. This is a yellowish, opaque, viscid liquid produced in the cells of the liver and stored up pending the necessity for its use in what is known as the gall-bladder. This latter is a pouch-like reservoir situated at the anterior and under surface of the liver. The bile is poured from this into the small intestine during the process of digestion. The uses of this bile were detailed in our discussion of the digestive work carried on in the small intestines.

The second class of work done by the liver is what is known as the change of the absorbed foods into such material as may be assimilated or used by the tissues themselves in all parts of the body. The absorbed foods which are changed by the liver are, first, absorbed sugars, technically known as dextrose. When this material reaches the liver, having been brought from the intestines, that portion of it which is not needed immediately by the tissues, is changed back into a form of animal starch known as glycogen, and stored up in the cells of the liver for future use. Second, the albumins which have been brought from the intestines after being digested, are chemically changed in the liver to such proteid material as the tissues are capable of assimilating.

The third class of work done by the liver is connected with the excretion of broken down tissue of the body or worn-out-bodily tissue. The blood from all parts of the body carries to the liver worn-out or broken-down tissues. These particles, which are useless, are changed in this organ to a material called urea, which can naturally be filtered out of the blood by the kidneys. This urea, manufactured in the liver in normal conditions, is sent by the blood current to the kidneys, there to be excreted. In abnormal conditions many diseases, such as rheumatism, gout, neuralgia, disturbances of circulation, heart trouble, etc., are caused by a failure of the liver to complete this work properly, so that instead of producing urea from the broken-down materials of the system, uric acid and its salts are produced, and these not being

filtered out by the kidneys, are backed up into the body and deposited in many tissues, poisoning the nervous system, causing muscular and joints pains, and many other ills.

From the foregoing description of its labors, one may easily see that the character of the diet and the amount of the food digested are of prime importance in this matter. Overloading—overworking of the liver, sooner or later, causes break-downs, and nine-tenths of humanity today suffer multifarious ills from this cause.

The pancreatic juice referred to in the process of intestinal digestion is produced, or as we usually say, is secreted by a gland of considerable size known as the *pancreas*. It is elongated and triangular in form, and occupies a horizontal position along the posterior abdominal wall behind the stomach and the transverse colon. The narrow end at the left touches the spleen, while the right end, which is thicker, fills out the concave space formed by the duodenum. The excretory duct of the pancreas empties into the duodenum at about the same place as does the bile duct.

In point of location *the spleen* is so closely associated with the digestive organs that it may as well be described here as elsewhere, although it is not essentially a part of the digestive system. We may say that the exact functions of the spleen are not thoroughly understood, and we therefore have no special place in any other chapter in which to take it up. It has been assumed that it affects or elaborates certain elements of the blood, but we have not been able to learn as much of the work of this organ as we have of practically all of the others. More recently, the spleen has been believed to produce an internal secretion that stimulates the formation of gastric and intestinal digestive fluids. It is on the left side, fairly well back, and situated between the stomach and the diaphragm. After unusually violent exercises the spleen may sometimes be overfilled with blood, causing pains or stitches in the side, and in some diseases, such as malaria and typhoid, it may enlarge sufficiently to be felt beneath the ribs of the left side.

The Circulatory System.—In the study of the structure and workings of the heart and vascular system we are impelled almost to conclude that the heart is the most important of all the organs of the body. But it would be a mistake to discriminate between various parts or systems of the body, all of which are absolutely essential to life. As we have seen, the center of life and of human power is undoubtedly the nervous system, and yet in order to maintain life in the issues it is essential that they be continually supplied with

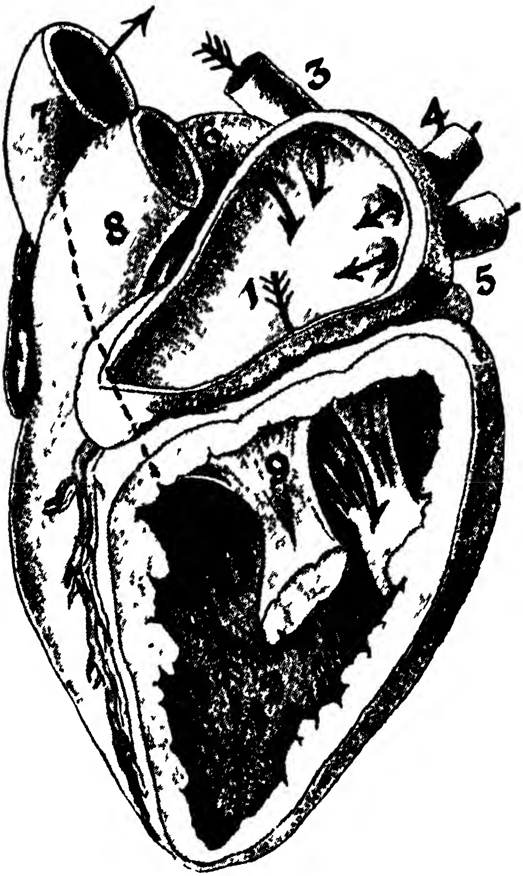
the new materials necessary to keep them in constant repair, it being the province of the blood to carry to every minutest part of the body this new building material, which we call nutrition, and also the vitalizing oxygen, at the same time carrying away the poisonous waste products, which, if not removed, would instantly clog the action of the vital machinery, with disastrous results. And since it is the heart that keeps the blood in constant movement, or as we say, circulation through every part of the body, men have commonly come to regard this organ as the most vital of them all. We know that if the circulation is interrupted for an instant because of a failure of the heart to perform its function, either through violent injury or other cause, the life of the individual terminates abruptly as a consequence.

The human heart is really a powerful double pump, as we shall see from its structure, and the most remarkable example of muscular vigor in the entire body. It consists of involuntary muscles, in other words, muscles which are not subject to the volition of the individual. In any condition of the most extreme muscular fatigue the heart is the very last part of the body to become exhausted. Yet it is possible for the heart to become fatigued to such an extent that its efforts are either somewhat or very weak.

Still, prolonged fatigue of the heart is most unusual except as the result of the greatest bodily exertion, prolonged excitement producing utter exhaustion of the entire body generally. Sudden and extreme fatigue of the heart sufficient to suspend its action is a possibility, but all such cases are out of the ordinary.

The heart has something of the shape of a large pear, situated in the central forepart of the chest, with the lower end, which might be termed the apex of the somewhat cone-shaped organ, turned toward the left side. The work of pumping the blood and thus propelling it through the blood vessels is accomplished by the muscular contractions of its walls, each vigorous contraction being succeeded by a very brief instant of relaxation. It is this mere instant of relaxation of the muscular tissues of the heart, between each "beat" or contraction, which enables the organ to recuperate completely and to continue its work without any apparent rest. The act of contraction causes the apex of the heart to strike against the front chest walls, not altogether unlike the action of the "kick" or recoil of a gun, and it is this striking that we can feel and hear, and which we speak of as the "beating of the heart" in common parlance.

The heart is generally about the size of the clenched fist of its possessor, or perhaps a little larger. In weight this vital organ may range from 9½ to 11½ or more ounces, averaging 10 ounces, in the male. The female heart is smaller in size and weight. It is supported in a bag consisting of a double layer of membrane, which enables it to contract and relax without friction. This sac is known as the *pericardium*.



A drawing of the interior of the left side of the heart, indicating the left atrium and ventricle, the mitral, and the openings for the aorta and the pulmonary veins, showing:

1. Left atrium
2. Left ventricle
3, 4, 5 and 6. Pulmonary veins
7. Aorta
8. Pulmonary artery
9. Biscupid, or mitral, valve

A hollow, muscular organ, the heart's interior is divided by a partition in such a manner as to form two chief chambers or cavities, one to the right and one to the left. Each of these chambers is again subdivided into an upper and a lower portion, called respectively the *atrium* (formerly called *auricle*) and ventricle, which freely communicate one with the other. The aperture or point of such communication, however, is guarded by a sort of valve which allows the blood to pass freely from the atrium into the ventricle but not in the opposite direction. Thus there are four cavities altogether in the heart—two atriums and two ventricles; the atrium and ventricle of one side being quite separate from those of the other.

The right hand atrium communicates with the veins of the general system and also with the right ventricle while the latter leads into the pulmonary artery, the orifice of which is guarded by a valve. The left atrium, on the other hand, communicates with the pulmonary veins and with the left ventricle, the latter leading directly into the aorta, the large artery, which conveys blood to the general system and whose orifice, like that of the pulmonary artery, is guarded by valves.

A little consideration of this arrangement of the heart's valves will show that the blood can pass only in one direction, which is as follows: From the right atrium, it flows into the right ventricle and thence into the pulmonary artery by which it is conveyed to the capillaries or minute blood vessels of the lungs. It may be interesting to note that the pulmonary artery is the only artery in the body which carries impure or so-called venous blood. From the lungs the blood, now purified and altered in color, is gathered by the pulmonary veins and taken to the left auricle, from which it passes into the left ventricle and thence into the aorta, by which it is distributed to the capillaries of every portion of the body. The branches of the aorta, which are distributed throughout the general system, are called systemic arteries, and from these the blood passes into the systemic capillaries, where it again becomes dark and impure. Next, it flows into the branches of the systemic veins, which at the point of their union form two large trunks called the superior and inferior vena cava, from whence it is discharged into the right atrium, from which the blood started in the first instance to circulate throughout the arterial and venous systems.

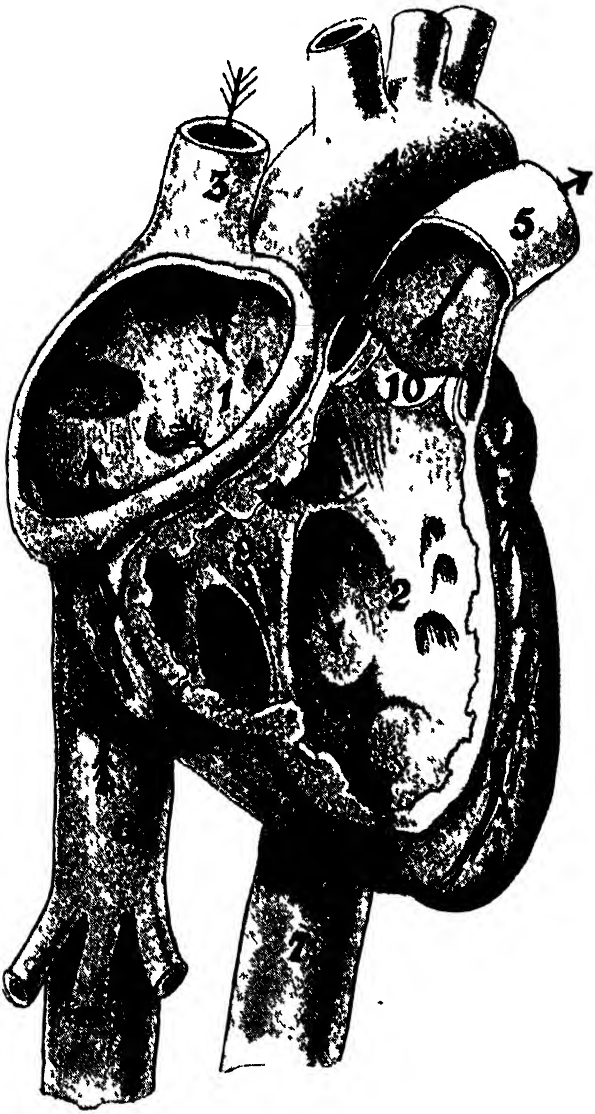
The heart's action in propelling the blood consists in the successive and alternate contractions and dilatations of the muscular walls of its two atriums and two ventricles. The atriums contract simultaneously; so do the ventricles.

The heart beat naturally varies with different individuals according to temperament, vigor and other factors, but as a general average we may say that in adult males it beats about seventy-two times a minute, in women about eighty times a minute. Thus in men the heart-beat averages four thousand two hundred times an hour, one hundred thousand eight hundred times a day and over thirty-six million times a year. At each beat of the heart, over two ounces of blood are thrown out of it, one hundred and eighty ounces a minute, six hundred pounds an hour, and about eight tons per day.

All the blood in the body may pass through the heart in less than two minutes.

This little organ, by its ceaseless industry, pumps each day what is equal to lifting one hundred and thirty tons one foot high, or one ton one hundred and thirty feet high.

The aorta subdivides into several large arteries, these subdivide



This drawing shows diagrammatically the interior of the right side of the heart, showing the right atrium and ventricle and the tricuspid and semilunar valves. The arrows indicate the openings for the superior and inferior Venæ cavæ and pulmonary artery.

1. **Right atrium**
2. **Right ventricle**
3. **Venæ cavae superior**
4. **Ascending aorta**
5. **Pulmonary artery**
6. **Venæ cavae inferior**
7. **Descending aorta**
8. **Fossa ovalis**
9. **Tricuspid valve**
10. **Semilunar valve**

into smaller ones, and so the division goes on until the ultimate arteries are so fine that they cannot be compared even to a hair in size. As the arteries carry the blood out from the heart so the veins carry it back again after it has performed its work of rebuilding the cells of the body. The veins exist everywhere in the body as canals supplementary to the arteries.

Between the veins and their corresponding arteries lie tiny blood vessels—hair-like canals—that connect the veins with the arteries, and these are the capillaries which already have been mentioned. They are so infinitesimally fine that they can be seen only with the aid of a powerful microscope. It is these capillaries that carry the new nourishment to be absorbed by the cells of tissue, and between the capillaries and the cell-walls lies the useful lymph. The study of the lymph will be taken up later on.

From the arteries blood is forced into the capillaries by means of the contraction of the very elastic walls of the former. One of the great difficulties of extreme old age lies in the fact that the walls of the arteries lose or tend to lose this elastic quality. It is this quality also which enables one to "feel his pulse," for as the contraction or so-called "beat" of the heart forces another two or more ounces of blood into the arteries it causes this wave, which we feel in the pulse, to pass through all of the arteries. The walls of the arteries expand with each such wave of blood, but so remarkable is their elastic and contractive power that in the scant interval of a part of a second elapsing before the next wave or pulse, they have forced the excess of blood through the capillaries and decreased their size. By counting the pulse of any artery to be reached conveniently one can count the number of heart beats per minute. Everyone is familiar with the manifestation of the pulse at the radial artery, near the outer side of the wrist, when the palm is turned upward.

The Blood consists of a liquid plasma, which is of a light straw color. The bright red color of arterial blood is due to the presence of red corpuscles, and the red coloring matter of these corpuscles is called hemoglobin. These red corpuscles are disks that are concave on both sides, and of an average diameter of 1-3200 of an inch. They are so elastic that they can be forced readily through openings of diameter less than their own. Once on the other side of the opening the corpuscles resume their natural shape. So tiny are these corpuscles that millions of them will lie in the space of a square inch; were all of these corpuscles in a healthy adult person arranged in a

single, continuous line, they would cover a distance of one hundred thousand miles. The important work of the red corpuscles is to carry oxygen to all parts of the body.

Exercise creates a demand for more oxygen and thus forces the inhalation of greater quantities of air; this oxygen naturally must be carried through the body, and this increases the work of the red corpuscles. Nature meets this greater demand upon the red corpuscles by supplying more of them to do the work. Up to the limit of beneficial exercise the number of red corpuscles is steadily increased. When exercise is carried past the point of benefit, and exhaustion begins, the number of red corpuscles diminishes. Scientific physical trainers sometimes examine under the microscope samples of blood taken from athletes in various stages of exercising. It is possible, thus, to determine, approximately, the extent to which any exercise is carried with benefit.

There are also in the blood colorless corpuscles, generally known as the *white* corpuscles and scientifically as *leucocytes*. These are somewhat larger than the red corpuscles, averaging 1-2500 of an inch in diameter. They are irregular in shape, are constantly changing their shapes, and appear to be very active. Leucocytes increase immediately after feeding, and are much less numerous when the stomach is empty. The functions of the red corpuscles is to carry oxygen and possibly other nourishment to the body cells, and carbon dioxide to the lungs. While the functions of the white blood cells are not fully understood, it is known that they protect against infection by combining with or destroying toxic elements.

Blood-Pressure.—The pressure of the blood upon the walls of the arteries is known to us as blood-pressure. Details of the significance of blood-pressure, and its relationship to health and ill-health, are given in Volume V.

The Lymphatic System of the human body is in actuality a supplementary circulation. The blood current of the general circulation is the common carrier of the body as the railroads are in a country. The blood at various points in the system, such as the lungs and intestines, picks up the various nutriment necessary, such as oxygen and digested foodstuffs, and, carrying them to the various tissues, there unloads them. At the same time, while in the tissues, the various broken-down products of human life are picked up by the blood current, and carried to those several organs, namely, skin, lungs and kidneys, by which they are excreted. Thus, we see that the blood

circulation is a continuous round of action. The lymphatic system, on the other hand, differs from the above by beginning the flow of its contents in the tissues, steadily converging toward the center of the body and ending in the depths of the chest. The lymph is formed by the fluid constituents of the blood passing through the walls of the blood vessels. It may be described as blood fluid without the red corpuscles.

Anatomically, the lymphatic system consists of three parts, lymph spaces, lymphatic vessels, and lymphatic glands. The lymph spaces are cavities, mostly of microscopic size, situated between the cellular elements of the tissues. The lymphatic vessels are delicate tubes with transparent walls formed of the same three coats as the arteries, and found in all parts of the body, except the nails, superficial skin, hair and cartilages; they are provided with numerous valves, like the veins which open only toward the center of the body and which give a characteristic beaded appearance to these vessels.

The lymphatic vessels found in the abdomen, connected with the stomach and intestines, are called lacteals, from the Latin word for milk, because during digestion the fluid which they carry is white, like milk, owing to the fact that it is by this means that the absorbed emulsified fats are taken into the system. It must be remembered that while some nourishment is absorbed from the stomach directly into the blood, yet that organ is more concerned in the work of *digesting* food. It is in the small intestine that absorption is most active.

Embedded in the mucous lining of the small intestine are millions and millions of villi. (Villus is the singular form of the word.) These villi are so tiny that hundreds of them are to be found in a space half an inch square. Each villus consists of a cluster of blood vessels and one vessel called the lacteal. The lacteal absorbs from the chyle in the small intestine the nourishment that it wants, and infinitely minute particles of fat are taken up. The lacteal fluid is not yet in proper condition for combination with the blood, so it passes from the lacteals into the mesenteric glands. These glands, each about the size of an almond, and some one hundred and fifty in number, are situated in the mesentery, a membrane suspended from the rear wall of the abdomen.

It is supposed that in the mesenteric glands the lacteal fluid is filtered; afterward the fluid flows into a reservoir, known as the receptaculum chyli, placed against the front of the spinal column in the

upper portion of the abdominal cavity. From this reservoir there runs a large lymphatic vessel, called the thoracic duct, upward and to the left along the spinal column, where it ends by a guarded mouth in the junction of the great veins at the root of the left side of the neck; thus pouring its contents directly into the blood current on its return to the heart. This thoracic duct, besides bringing this milky fluid from the lacteals of the abdomen, is also the final conveyor for all of the lymph from the lower extremities, abdomen and chest. It is about fifteen to eighteen inches long in the adult, and is guarded at its termination by double, half-moon shaped valves. On the right side of the neck, symmetrically placed with the termination of the thoracic duct on the left, is a short, large lymphatic vessel known as the right lymphatic duct. This is the virtual terminus of the lymphatic vessels of the head and upper extremity of the right side. It also discharges its contents into the junction of the great veins at the root of the neck, but on the right side. Its terminal opening is guarded similarly to that of the thoracic duct.

Situated in the course of these lymphatic vessels, chiefly in the great cavities of the body, along the course of the great blood vessels in the spaces near the larger joints and distributed in the neck, are many small, round or oval bodies called lymphatic glands. These glands are composed of an outside fibrous capsule, which sends partitions inward in all directions forming irregular spaces in which lie the gland-pulp or lymphoid tissue. The latter consists of a web-like network of fine fibers, holding in its meshes the lymph cells. These lymph cells resemble in every particular the white corpuscles of the blood, and, in fact, are the direct parents of the majority of these corpuscles.

Before entering a lymphatic gland, a lymphatic vessel breaks up into several branches, which enter the gland, and there further divide into a network of very small vessels resembling the capillaries of the blood circulation. When about to leave the gland these tiny vessels reunite into several tubes resembling those which entered the gland. And these again in turn unite to form a single lymphatic vessel continuing its way toward the center of the body. The lymph, or the fluid which is carried by this supplementary circulation, is formed by the filtration of the liquid of the blood through the walls of the capillaries into the lymph spaces, which lie outside the capillaries and between the cells of the various tissues. This lymph thus carries to the tissues the nutriment which they need for their organic activity, and, losing

that part of its cargo, takes up from the tissues the waste products of animal life and carries them onward and inward, finally to pour them into the blood current at the root of the neck, from thence to be taken by the blood to the various excretory organs.

By this time it must become evident to the reader, that while the blood circulation is the common carrier of the body, the lymphatic system is the main distributing and collecting agency.

The lymphatic glands, which have previously been described, have a function in the human body peculiarly their own. Situated as they are in the course of the lymph flow and forming a part of the channel through which that fluid must go, they act as filters of that liquid. This filtration is accomplished in two ways: First, mechanically; and, second, organically. When anything foreign or deleterious to the well-being of the system at large is picked up and carried inward by the lymph current, the first lymphatic glands with which this antagonistic material comes in contact attempt to bar its progress. As a result of this work, the glands swell, become tender and painful and in many cases soften, break down and discharge, through the surface of the body, a fluid resembling pus; by this means removing the offending material from the interior of the system and making void any possibility of danger from its previous presence. Examples of the foregoing function of the lymphs are of more than daily occurrence.

The quality and purity of the blood stream, perhaps next to the possession of an adequate supply of nerve-energy, is the most important of all factors in the preservation of health and life. In truth, the degree of nerve energy and the state of the blood are so interdependent that one is scarcely justified in attempting to consider them separately and independently. Either one is impossible without the other, as we have already shown. If the blood is kept pure and rich, and if it circulates actively and vigorously, then every part of the body will be perfectly provided for, the nervous system will be charged with vital energy, and it will be impossible for any part of the entire human system to become deranged except through the accident of external violence or the introduction of poisons, either directly into the blood or through the stomach.

The Respiratory System—The Channels of Purification.—The absolute and uninterrupted persistence of the act of respiration is one of the wonders and also one of the most imperative essentials of life. Its cessation for only a few moments means death. We can give our stomachs a rest if we choose, even for days, and we might

be able temporarily to suspend some of our other functions, but breathing must be continuous. For this reason we are accustomed to speak of the lungs along with the heart under the classification of vital organs.

The processes of life depend, among other things, upon chemical action, requiring most of all a constant supply of oxygen in order that the essential combustion may be carried on and waste eliminated. This oxygen is supplied to the blood from the air through the marvelous mechanism of the lungs. But not alone this, for the lungs are the medium through which the body is relieved of waste-poisons which are constantly being produced in the processes of living, and which, if not eliminated, would mean the cessation of these processes within a few moments.

As the blood circulates through the body, nourishing all the tissues and supplying to the organs of secretion the materials necessary for their special work, it not only loses its nutritive quality but it also becomes charged with the waste matter and impurities mentioned. The purification of the blood is accomplished by the various excretory organs, the office of the lungs, the most important of these, being to relieve the vital fluid of one of the most important of these impurities, namely, carbonic acid. It is for this reason that, when one has been compelled for some time to breathe the confined air of a small room, this atmosphere becomes so charged with carbonic acid gas that it is unfit to breathe. The breathing of this gas, if persisted in without change of air, would prove fatal.

As previously stated, the lungs supply the blood with oxygen at the same time that they enable it to get rid of this poison. The oxygen not only burns up much of the waste and refuse matter that gathers in the body, but in addition stimulates the action of the organs in general and does other work in preserving health and vigor. It will be seen, therefore, that the lungs are most essential and important organs, being so intimately identified with the circulation upon which life depends.

Later in this Part we shall consider the other purifying or excretory organs, the kidneys, the skin and the helpful service of the intestinal tract. It will be noted that the functions of the skin are not limited to those of waste elimination, but its service in this respect is of very great importance and it also will be taken up in the present Part.

An understanding of all these channels of purification is most essential. The relation of these special organs of elimination to the conditions which make disease a possibility will be obvious from what has

already been said in previous chapters. If the blood is kept absolutely pure and charged with the nutritive elements necessary to sustain every part of the body, so that the important organs will be provided with the materials and energy with which successfully to accomplish their respective functions, and every tissue be kept clear and clean of accumulating wastes, then there can be no such thing as disease.

Let us now consider the work of the lungs in relieving the body of carbonic acid, and simultaneously supplying oxygen. Just how important is this work may be seen very quickly by the experience of choking or suffocating, by means of which the breath is shut off and the process stopped. In a few seconds a dreadful condition arises, accompanied by the terrible and desperate sensation of smothering. The lungs can no longer purify the blood stream which surges through them continuously at the rate of two to three ounces per second, or at the remarkable rate of four to five quarts per minute; the entire blood supply of the body becomes saturated with the rapidly accumulating poison; even the blood in the arteries loses its pure, bright scarlet, arterial color, this giving place to the dark crimson of the venous blood; and the natural color of the face, perhaps a bright pink or rosy flush, is changed to a dark purple. If one struggles or exerts himself while choking, then the process is all the more rapid, the accumulation of the poisons being accelerated in proportion to the intensity of the effort.

The lungs occupy the greater portion of what we call the "chest," this being the uppermost of the two great cavities into which the trunk of the body is divided. Somewhat between the lungs, and to the front, lies the heart, completing the group of vital organs contained in the chest and protected by its walls. The division of the trunk or torso into the two cavities referred to is accomplished by the diaphragm, a rather remarkable structure which forms the floor of the upper or lung and heart cavity, and the roof of the cavity beneath containing the digestive and other abdominal organs. There are convenient openings in it through which pass the esophagus, the aorta, the vena cava, and other important channels. The diaphragm is chiefly a muscular structure, though partly tendinous, being perhaps best described as a membranous muscle. It has somewhat the form of a large shallow bowl inverted, so that with its contraction it flattens, pushing down upon the organs underneath, and causing the expansion of the body below the waist line that is observed in natural breathing. With this contraction, thus lowering the floor of the lung cavity, a partial

vacuum is created which causes the external air to rush in. This is normal and natural inspiration. As a rule, the expansion of the chest for the same purpose is not required except during the need for an exceptional amount of air. But the practice of breathing, with special exercises, for the improvement of the lungs, and, through them, of the entire body, will be taken up in another place.

The lungs are of a spongy, elastic texture, but appear to the naked eye as if they were, in great part, solid material. As a matter of fact, they are hollow organs, not unlike two bags containing air, each bag communicating by a separate opening with an air tube, the *trachea,* through the upper portion of which, the *larynx,* they are put in touch with the outer atmosphere. The aperture of the larynx can be opened or closed at will by an involved system of muscles.

Each lung is enveloped in a sort of fibrous bag, which has a very smooth lining. The lung itself has an outer surface which is very smooth, and which moves easily over the inner surface of the bag, or *pleura,* that envelopes it. Nevertheless, the relation of lung to pleura is so intimate that there is no actual space between the surfaces of the two except after death or as the result of some diseases.

The trachea, the large tube which is popularly known as the "wind-pipe," and through which the air passes into the lungs, divides into two branches or *bronchi*—one for each lung. These bronchi divide and subdivide into a number of small branches penetrating every part of the lungs until they end in the fine subdivisions of the latter, called the *lobules.*

Each lung is partially divided into *lobes,* the right lung having three and the left two. A lobe is composed of a large number of minute lobules. A lobule may be considered as a microscopic lung, inasmuch as it contains a branch of the bronchial tube as previously stated, air cells, blood vessels, nerves, lymphatics, etc.

On entering a lobule, the division of the bronchial tube keeps on dividing until its walls become an extremely thin membrane, pouched into small dilatations, called air-cells.

Without going into a technical description of the mechanism of the air-cells, it may be briefly stated that outside of them is a network of pulmonary capillaries, or minute blood-vessels. Air, on being inhaled, comes in contact with the blood in the lung-capillaries by means of a very wonderful device of Nature, by which there is an interchange of oxygen of the air for the carbonic acid in the blood through the membrane of the air-cells. This carbonic acid is exhaled,

there is a distribution of the oxygen, and so the process of respiration continues indefinitely. The enlargement of the chest in inhalation is a muscular act, the muscles concerned being chiefly the diaphragm, the internal intercostal muscles, a portion of the chest muscles and some others. The relaxation of the muscles after such effort brings about expiration, under normal conditions.

In singing, sneezing, coughing, etc., certain other muscles are brought into play, however, the chief of which are to be found in the abdominal region, together with those that depress the ribs.

The blood is conveyed to the lungs by the pulmonary arteries to be purified in the former in the way described. The blood needed for the nutrition of the lungs and their connective parts is supplied by the bronchial arteries, and having fulfilled its purpose is carried into the pulmonary arteries and is purified and vitalized in due course.

The blood, as it passes through the lungs, changes greatly in color, the dark crimson of the venous fluid being exchanged for the bright scarlet of the arterial blood. In addition, the blood, as intimated, gains in oxygen, loses carbonic acid, becomes one or two degrees warmer, coagulates sooner and more firmly, and contains more fibrin.

The oxygen which is absorbed into the blood from the atmosphere through the action of the lungs is combined chemically with the hemoglobin of the red blood corpuscles. In this condition it is carried in the arterial blood to the various parts of the body and brought into contact with the elementary portions of the tissues. In so doing, it cooperates with the process of nutrition and in the removal of disintegrated tissue matter during which a certain proportion of the gas disappears and a like amount of carbonic acid and water is formed.

The venous blood, charged with this same carbonic acid, returns to the lungs where the gas is exhaled and a fresh supply of oxygen is secured.

The stopping of the respiratory movements from any cause results in the retarding of the circulation and finally venous congestion of the nervous centers, with resulting death.

Considering the vital character of the function of the lungs, it will be seen how important it is that we provide natural and favorable conditions for their exercise, and also that we use them freely. Men and women, especially those confined to indoor occupations and sedentary habits, commonly neglect their lungs by persistent shallow breathing. This is none the less detrimental because it is thoughtless. The only surprise is that those who are guilty of such neglect get along

as well as they do. It is only another proof of the wonderfully efficient character of the lungs that they do so well under such unfavorable circumstances.

In the practice of special breathing exercises it is important to avoid holding the breath for more than a moment, for reasons which our study of the actions of the lungs has just made clear. To hold the breath is to defeat the very purpose for which one may take breathing exercises, inasmuch as it is only a form of temporary suffocation. To hold the breath is to produce a condition in the lungs similar to that in an enclosed room in which most of the air has been vitiated by repeated breathing.

There is also a special reason why one should take some moderate, healthful exercise, if possible, in connection with his daily breathing exercise. This is because we can by this means more perfectly accomplish the oxygenation of the blood and the combustion and elimination of the wastes of the body. We all know how much more rapidly we breathe when taking vigorous exercise, for under such circumstances we consume and require far more oxygen than when physically passive or at rest.

This need or demand for oxygen might be referred to colloquially as a condition of oxygen-hunger, and the degree of this will determine just how much oxygen will be absorbed from the air in the lungs. Active exercise will create this condition of oxygen-hunger and the deep breathing which naturally ensues under such circumstances is far more beneficial than that taken in a state of general bodily rest, although this, too, as we have seen, is highly to be recommended. The amount of oxygen absorbed, of course, is partly a matter of the activity of the circulation, for the red corpuscles are always well supplied with the vitalizing and electrical gas, and always leave the lungs in a bright scarlet condition. When we need more oxygen, then the heart beats faster and the blood streams through the capillaries of the lungs much faster, picking up the oxygen from the air-cells more rapidly and giving up the poisonous gas with equal speed and in similar volume.

Excretory Organs.—Working in connection with the lungs, as already noted, are the kidneys and the pores of the skin, removing the other wastes of the body. The intestines are sometimes regarded as of a depurating character, but they are properly digestive and assimilative organs, their excretions having to do chiefly with the waste matter of the foods and digestive fluids. However, they do assist some-

what in the general work of elimination, and especially during diseased conditions, where there is an excess of poisons in the body. Under such circumstances, when the appetite fails, the tongue is coated and the breath bad, one may surmise that the entire alimentary tract is brought into service for the purpose of elimination. The advantage of drinking water freely in such a case is obvious, although the increased supply of water in the body generally is favorable to the more efficient action of the kidneys and skin as well.

The Kidneys are the organs of the human body by which the major part of the broken-down or waste material resulting from physical activity is excreted or cast off from the body.

These organs are situated deep in the loins, one on either side of the spinal column, embedded in a mass of fat. Each measures about four inches in length, two and one-half inches in breadth, and about one inch and a quarter in thickness. They weigh, in the average adult, about five ounces each and their approximate shape is that of the well-known kidney bean. The kidneys lie with their greater convexity toward the sides of the body, and the depression, or nick, toward the middle line, each facing the one on the opposite side. In this depression, all the blood vessels and nerves of the kidneys have their entrance or exit, and from it comes a tube, called a ureter, which carries the urine from the kidney to the bladder.

The right kidney is situated directly behind the liver, and the ascending portion of the large intestine; while the left has, in front of it, the large end of the stomach, and the first part of the descending portion of the large intestine. The lower tips of both kidneys are two inches above the upper edge of the haunch bones, the right kidney being somewhat lower than the left.

A fibrous capsule envelopes the entire kidney, which, sending projecting partitions within, forms the framework of the organ.

The cortical, or outer portion of the kidney is composed of convoluted, or twisted and straight, tiny tubes, each of which arises in a spherical, hollow capsule of minute size, containing a bundle of twisted capillaries or small blood vessels. The central or medullary portion is composed of pyramids, eight to eighteen in number, with their peaks or points directed toward and located at the depression, or sinus, on the internal edge of the kidney. These pyramids are composed of bundles of microscopic straight tubes which finally join together in one opening at the apex of the pyramid. The fibrous capsule previously described as investing the whole organ dips into the

depression on the inner edge of the kidney, covering each and every pyramid's point, but at each such point there is a mouth, or opening, from the final tube of each pyramid. Surrounding all of these openings, and narrowing as it leaves the kidney, is a fibrous funnel, known as the pelvis of the kidney, which unites at its narrow end with the ureter, or pipe of transmission to the bladder.

The circulation of the blood in the kidney, being of prime importance in this organ, calls for special description. The renal or kidney artery, which is a branch from the largest artery in the body, divides on its entrance into the depression of the kidney, into five branches, which as they pass up between the pyramids subdivide again and again, finally terminating in two sets of capillaries. One of these sets may be found occupying the cavity of the minute spherical capsules previously described, while the other capillaries ramify about the twisted and straight tubules. The blood is re-collected from these capillaries by little veins, which join each other as they descend between the pyramids, finally to combine into one, called the renal vein, which ultimately pours its contents into the largest vein in the body. Thus, you see that the circulation through the kidney is directly from the largest artery in the body to the largest vein in the body.

The broken-down or waste material of the various tissues of the body goes through various processes before it is prepared to be excreted by the kidneys. As any tissue breaks down and wears out, the used-up portion is dissolved by the blood at the place where it was produced, and carried by the blood current to the liver. In this organ the waste materials from all parts of the body are collected, and so chemically changed or transformed that they are fit for filtration from the blood by the kidneys. These changed materials, the most noticeable of which is urea, are again dissolved in the blood at the liver and carried from thence to the capillaries in the kidneys.

The walls of these capillaries, especially those of the first set described, are exceedingly thin, and the pressure in the blood vessels being much greater than in the cavities of the tiny spherical capsules and minute tubes, the water of the blood (containing in solution the urea and other waste products) passes through this thin wall, leaving the solids and albuminous constituents of the blood behind, and flowing down through the little tubes, is known as urine.

Human urine is a straw-yellow, limpid fluid, transparent, with a mild odor, acid and weighing, normally, about one and one-fortieth times the weight of pure water. Diseased conditions, not only in

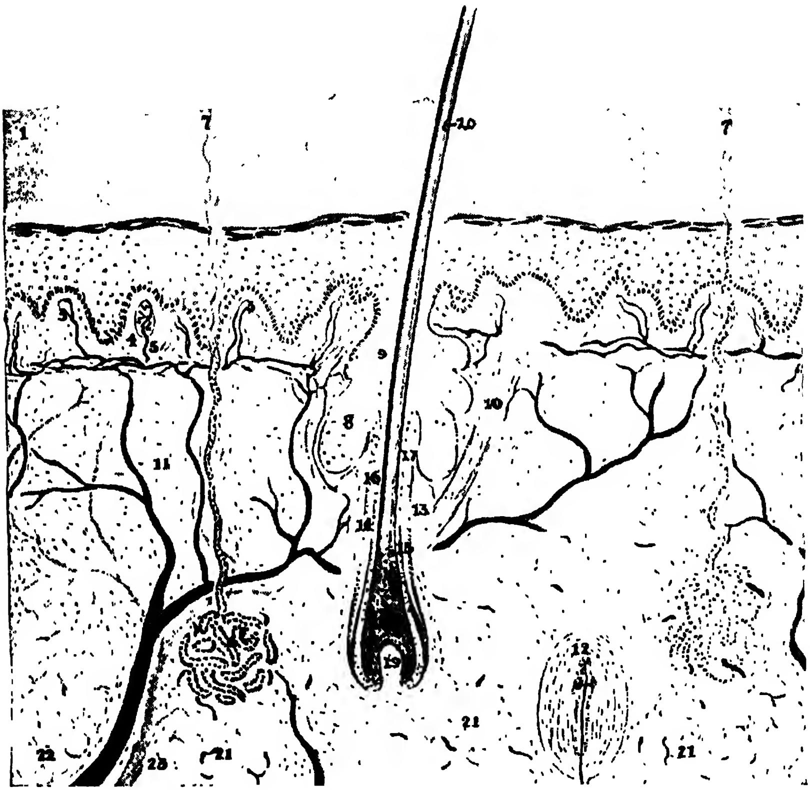
the kidneys, but in the heart, in the brain, in the lungs and in the arteries of other parts of the body, as well as natural changes in the blood pressure in distant parts of the body, cause great modifications in the quantity, as well as the quality of the urine excreted. For example: In summer, when the skin of the body, owing to the external heat, is filled with blood, sweating is profuse, and the quantity is markedly diminished. In winter, when the skin is chilled and the blood vessels in it contracted, the amount of urine is increased. Under stress of nervous shock or emotion, the urine is many times greater in quantity. Disease or disturbance of the digestive organs, especially of the liver, cause a defective transformation of waste materials into the urea, producing by-products, such as uric acid and urates, which, when excreted in the urine, cause the latter to become darker, very acid, and to deposit the well-known brick-dust sediment. This is one of the greatest causes of stone in the bladder. Diseases of the kidneys themselves, wasting diseases of the general system and any temporary stress of overwork or worry is liable to cause albumin to appear in the urine. Disease of the nervous system, in some of its many forms, causes sugar to make its appearance in this excretion and its permanent appearance therein is a symptom of the disease known as diabetes.

The Skin.—The human skin, with its appendages, covering, as it does, the exterior of the whole body, is a most marvelously and ingeniously constructed tissue. Not only is it arranged and built in a general way to fulfil all the claims which may be made upon it, but it is also modified in various special localities so as to perfectly serve special functions.

For purposes of description the skin may be divided into three layers: First, the outermost one, called the epidermis or cuticle; second, the middle one, the derma or true skin; and, third, the subcutaneous layer.

The epidermis, or cuticle, being the most exterior, is in continual contact with all the constant rubbing and pressure to which the body is subjected. It is, therefore, from a purely mechanical point of view, the protector of the body. Owing to the constant rubbing and pressure of this layer, there is a steady loss from its surface by destruction and scaling of the living cells of which it is composed. In order, therefore, that under normal conditions this covering be not totally lost, there is a steady growth from the bottom upward of these cells.

The structure of this layer consists of one class of cells, called epithelial (which have already been noted in the classification of the tissues of the human body), but whose shape varies very markedly from within outward. At the inner surface of this layer, the cells are cylindrical in shape and soft in texture, growing more spherical and less soft as we reach the middle, while at the surface the cells

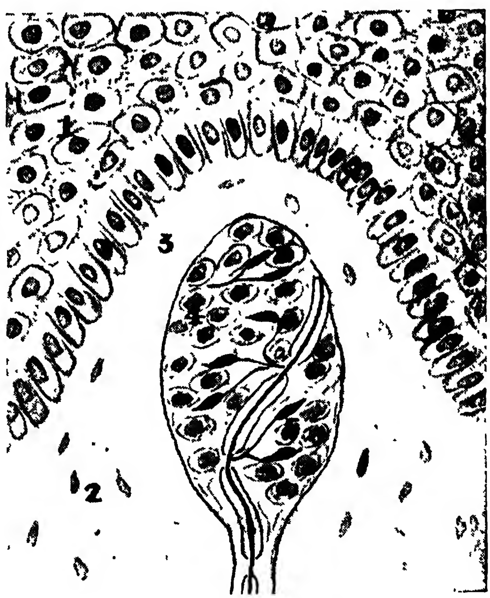


A highly magnified cross-section of the skin with structure of hair shaft.

1. Epidermis
2. Granular pigmental layer
3. Papilæ with blood vessels
4. Papillæ with touch organs
5. Nerve fibers
6. Sweat glands
7. Outer openings of the sweat glands
8. Sebaceous gland
9. Sebaceous duct
10. Hair muscles
11. Connective tissue fibers
12. Pacinian corpuscle
13. Hair follicle
14. Outer sheath of hair
15. Inner sheath of hair
16. Outside of hair
17. Core of hair
18. Bulb of hair
19. Papillæ at root of hair
20. Shaft of hair
21. Adipose tissue cells
22. Arteries
23. Veins

become flat, dry, and in some cases almost horny in consistency. The outer surface of this layer is virtually smooth, while its under or inner surface is undulating, dipping in between and rising over the prominences of the derma or true skin. In the innermost layer of this epidermis, we find the coloring matter which gives the lightness or darkness of shade to the human skin. This coloring matter is the same for all races, black, yellow or white, the difference of shade being produced by the amount of it present. Sunlight has the effect of causing more color to be deposited in the skin upon which it shines.

The nails on the fingers and toes are but modifications of this epidermal layer of the skin. They consist of the same epithelial cells, but are more flattened, more closely packed together and more horny in structure. At the base of each nail, there is a so-called root, embedded in a fold of the skin, from whence comes the growth in length of the nail, and underneath its concave surface is the *matrix* or "quick" of the nail, which is very full of blood vessels, and by means of which the nail grows in thickness. These nails on the human body, which at the present time merely protect the ends of the fingers and toes, were, in the early ages of human existence, intended also to serve, not only as tools, crude though they were, but as weapons of offence and defence.



Cross-section of skin, showing highly magnified details.

1. Outer skin, with pigment cells
2. Connective tissue fibers
3. Papillæ
4. End bulbs
5. Nerve fibers

The second layer of the skin, the derma or true skin, is a tough, flexible and highly elastic tissue, protecting the underlying parts, acting as the chief organ of the sense of touch and effecting by its various glands, not only the excre-

tion of sweat, but of an oily material whose purpose is to prevent the too-rapid drying of the epidermis. Throughout the derma are tiny muscular fibers that contract the skin.

This true skin consists of two layers. First, the *papillary layer*, situated upon its free surface, presents innumerable, minute, conical eminences, called papillæ, which contain innumerable tiny blood vessels with an average size of $\frac{1}{100}$ of an inch in length, by $\frac{1}{2000}$ of an inch in diameter at the base. These little mounds are very thickly arranged in paralleled curved lines, forming ridges, in the more highly sensitive regions, while in the less sensitive parts they are more thinly and irregularly distributed. In each of these minute mounds are found the terminations of the nerves of touch (the nerves of sensitivity).

It is from the blood vessels of the papillæ that the flow of blood comes when the skin is scratched. There are no blood vessels, lymphatics or nerves in the outer skin, the epidermis. There can be no pain in any of the cell layers of the epidermis, and such pain as is felt in the skin is inflicted, through the epidermis, upon the dermis. Second, the *reticular layer* contains interlacing bands of firm, white fibrous tissue, with yellow elastic fibers wherever hair exists, also lymph spaces and blood vessels.

Beneath this true skin is the *subcutaneous layer*. This consists of an open network of fibrous tissue, connecting the true skin with the tissues underneath and holding in its meshes a greater or smaller number of fat cells.

In the true skin, or in the subcutaneous layer, we find multitudes of sweat (*sudoriferous*) glands. Each of these has a single excretory duct and a little coil. The duct passes up between the little eminences called the papillæ and opens on the free surface of the epidermis.

Some sweat glands are found in the fatty tissue directly under the true skin. The sweat gland is a tube about a quarter of an inch in length, and the inner end is closed. These little tubes lie coiled in balls that are something like one-sixtieth of an inch in diameter. From the ball the tube extends wavily outward through the epidermis. At the back of the neck there are about 400 sweat pores to the inch, while in the palm of the hand there are some 3,000 to the square inch. The pore is the tiny open end of the gland in the outer surface of the cuticle. The sweat itself is made up of moisture, some salts, a little urea (a most important waste product of the body), and the

skin also depurates about one-fiftieth as much carbon dioxide as do the lungs.

The oil or *sebaceous* glands of the skin lie in the deep layers of the true skin, though they do not penetrate so deeply as do the sweat-glands. By means of small ducts they discharge into the hair-follicles and keep both the skin and the hair from becoming dry and brittle. They are found in the greatest profusion in the skin of the nose and upper cheeks, where their secretion, the *sebum,* formed by excretory products of the same nature as that discharged by the sweat-glands, mixed with fat, frequently clogs the orifices or mouths of the ducts. The sebum, thereby prevented from being discharged, hardens, becomes rancid, finally forming a whitish, worm-like coil of fat, sometimes with a black head, this latter being caused by the admixture of the fat with dust or other material on the face.

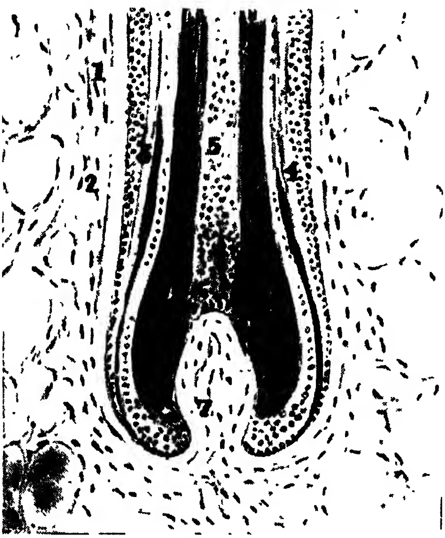
When forced out the extent of this hardened secretion gives an excellent idea as to the depth of the sebaceous glands. In addition to preventing brittleness of the skin and hair, this fatty secretion serves also to furnish the surface of the skin with a thin coat of oil, which prevents atmospheric changes from affecting the temperature of the body too rapidly and also tends to prevent an excessive loss of body heat from evaporation. The coating of grease which swimmers apply to their bodies before engaging in any race that will keep them in cold water for a long time serves the similar purpose of conserving heat.

The direct relation between the skin and the kidneys is shown by the fact that the more perspiration there is on the skin the less fluid is eliminated by the kidneys. In the winter, when the skin does not perspire as freely as in summer, the secretion of the kidneys is greatly increased. Conversely, it will be noted that when the kidneys are very active there is not present as much perspiration on the surface of the body. Exercise, therefore, is of direct benefit to the kidneys, inasmuch as it relieves the latter organs of much of what would otherwise be their work.

It must be understood that not all of the perspiration from the sweat glands is visible to the eye. Much of this perspiration passes off from the body in the form of vapor. It is to be understood, also, that perspiration must always result in the cooling of the skin. It requires heat to convert fluid into vapor, as in the case of the fire that is needed under a boiler in order to convert water into steam. The heat that is used in converting the liquid of sweat into vapor

is drawn from the skin, and thus the skin must be left cooler through the act of evaporation.

The hairs, which, like the nails, are modified portions of the epidermis, are found everywhere in the skin, except the palms of the hands and the soles of the feet, but vary greatly in size. Each hair consists of a root and a shaft, all situated in a deep, narrow cavity, known as a hair follicle. This follicle traverses the whole thickness of the skin, beginning generally in a subcutaneous layer and opening on the free surface of the epidermis. Into the deeper part of this follicle, there generally open from two to five glands, known as sebaceous glands, which secrete the oily substance previously mentioned. Each hair has attached to its base a minute muscular fiber by which it may be raised to an erect position. The sebaceous glands are found wherever there is hair, and are most abundant in the scalp, face, arm-pits, and around the various openings of the body. Although generally opening into the hair follicles, they frequently open on the free surface of the skin. These openings become very noticeable when plugged with dried secretion and discolored black by dirt, when they are known as "blackheads."



Greatly-magnified cross-section of the root of a human hair.

1. Hair follicle
2. Outer sheath layer
3. Inner sheath layer
4. Outside of hair
5. Core of hair
6. Bulb of hair
7. Papillæ

The skin of the human body has quite a number of various duties to perform. The most manifest of these functions, aside from that of depuration, is that of protecting from harm the more delicate structures that lie beneath it. This protection is accomplished in two ways: First, mechanically, by means of the cuticle or epidermis. This takes up the persistent constant rubbing and pressure which is applied to it every moment of the being's life, the outer cells being

constantly destroyed or rubbed off, while new ones steadily take their places. Second, the end-organs of the sensitive nerve-fibers in the papillary layer being of three kinds, namely, nerves of sensation, nerves of heat, and nerves of cold, these receive corresponding sensations of pressure or pain, heat or coldness, and by transmitting these sensations to the central nervous organism, serve as a warning to the individual economy that danger from injury, or extremes of heat or cold, is present. This warning, being followed by activities of various sorts, guards the human body from destruction.

The Tonsils.—The tissue of the tonsils is formed chiefly of lymph, and they are believed to supply phagocytes or toxin-digesting cells to the oral cavity, where they combat the bacteria entering the mouth. This would account for their rapid and extreme enlargement in some cases. While the tonsillitis thus produced may apparently be injurious to the system, it is impossible to determine how much more serious diseases are warded off through this extreme endeavor of the tonsils to fortify the gate of entrance.

The mucous membranes are now thought to be eliminative structures in certain conditions, particularly in fevers and the fast or reduced diet. Intestinal elimination during a fast proves this to be true. Even when no solid material will be eliminated for days, the enema may bring forth considerable mucus, which is darkly tinted as a result of an accumulation of poisons or waste materials being carried to and eliminated through the intestinal mucous membrane. An instance of elimination through the mucous membrane is with catarrh and colds. Substances ranging from a thin, watery discharge to a thick, yellow, pus-like accumulation, are expelled through these membranes.

The Organs of Special Sense.—Among the most interesting of all the organs of the body are those of special sense, or, in other words, those by means of which we are able to see external objects, to hear the noises which they may cause, to smell their odors, to taste them if placed in the mouth, and to feel their form, texture and temperature. We have already mentioned that the functions of the sensory nerves, have their end organs in the skin, providing for. the sense of touch by which we are able to "feel" things, and therefore it will not be necessary to consider them further in this chapter. It may be said, even of the other organs, that through them we literally feel external objects, that is, we "feel" the sensations produced upon our sense organs by the vibrations of light or of sound.

In the case of sensations of taste and smell, we "feel" directly the qualities of the objective matter, on the one hand, and the gaseous or dust-like emanations from it on the other.

The sense organs have an importance which is peculiar to themselves, inasmuch as they perform a kind of service which is utterly distinct from that of any of the other organs of the body. It is through them that we perceive our relations to the outside world by reason of which we are able to use and direct the voluntary muscular system, which is the immediate servant of our own volition, in an effective manner.

The Eye.—Man's organs of vision—which, like other special sense organs, is double—is situated in two conical-shaped bony cavities in the front part of the skull, one on either side of the root of the nose. The eyeball is an almost spherical-shaped mass, held in place in this cavity by three pairs of muscles, and the optic nerve, or nerve of sight; it is surrounded by loose fatty tissue and protected in front by the eyelids, whose lining membrane is reflected over the anterior portion of the eyeball.

The lids are composed, on their outer surface, of skin, and on their inner surface, of mucous membrane, held loosely together by connective tissue and reenforced at their edges by thin semilunar cartilages. At the junction of the two membranes is a row of stiff hairs, known as eyelashes, which protect the eye, serving as a screen, from the entrance of foreign bodies. At this edge there appear also the openings of little glands which secrete an oily material to lubricate the edges of the lids and these hairs. A stoppage and inflammation of one of these glands is commonly known as a stye.

On the upper, outside corner of the bony cavity containing the eyeball, which is known as the orbit, is a large gland known as the lachrymal, or tear-gland. This secretes tears, a slightly salty, watery fluid, which at all times keeps the anterior surface of the eyeball moist and at times, under the influence of certain emotions, is poured forth more or less copiously. The main duct from this gland leads to the cavity of the nostril on the same side, so that in the main the waste secretion discharges into the nose.

The muscles of the eye, as said before, consist of three pairs to each eyeball, and by acting in concert or antagonism cause the motions of the eye from side to side, up or down, and circularly on its own axis.

The eyeball itself is spherical in form, having a portion of a smaller

sphere engrafted on its front part. The larger sphere, which forms about five-sixths of the globe, is opaque, while the smaller, consisting of about one-sixth of the surface, is very transparent and is known as the cornea, or the window of the eye. The cornea is the projecting anterior portion of the eye and is set into the other portion of the outer coat of the eye, much as a watch-glass is set into the case of a watch.

In general, the eyeball consists of two parts: an envelope and its contents. The envelope is called the coat of the eye, while the contents is called the humors of the eye. The eye has three coats, which compose its envelope. The first, known as the *sclerotic* or hard coat, is composed of firm, white opaque fibrous tissue, and is the protecting coating of the eye. This coating covers five-sixths of the globe of the eye, being continuous in front with the cornea or window of the eye. It is thicker behind than it is in front, and is continued in the rear as the covering of the optic nerve. To this coat are attached the various muscles which move the eyeball, and over its anterior portion, and the front surface of the cornea, is found an exceedingly thin reflection of the mucous membrane lining of the lids. This is so thin that the whiteness of the sclerotic coat shows through, giving the appearance which we call the whites of the eye.

Underneath this white coat we come to the second, known as the choroid coat. This is formed mainly of blood vessels which are very numerous and very small, and among which is a heavy deposit of purple-black coloring matter. This choroid or dark coat completely lines the sclerotic everywhere, but at the junction of the latter and the cornea it projects inward toward the axis of the eye, and at this point there is a circular opening in it, known as the *pupil* of the eye. This opening or pupil of the eye is to allow the entrance of light into the interior.

Owing to the transparency of the cornea, that part of the choroid coat which depends upon the junction of the sclerotic and the cornea, and which is pierced by the pupil, can be distinctly seen in every human eye. This visible portion is known as the iris, which means rainbow, and is so called because of the various colors it exhibits in different people. The iris differs from the main portion of the choroid coat in this particular—that it contains two sets of very fine muscular fibers. One of these sets runs in concentric circles around the opening known as the pupil, while the other set runs in radial lines, like spokes of a wheel, from the center of the pupil as a hub.

When the circular fibers contract, the opening of the pupil is much narrowed, while on the contrary, should the radial fibers contract, the pupil is enlarged. By means of this mechanism, the amount of light allowed to enter the eye is increased or diminished according as the source of light is less or greater in intensity.

The third coat of the eye, the *retina,* or innermost coat, is composed almost exclusively of the tip ends of the fibers of the optic nerve specialized in such manner as to receive not only sensations of gradations of light, but also of color. This membrane is transparent, is much more sensitive in the rear portion, and disappears at the junction of the sclerotic and cornea in front. In the posterior parts where the nerve fibers come together to form the optic nerve, we have what is known as the blind spot, because we have no specialized nerve endings there.

Directly behind the iris we find what is known as the *crystalline lens.* This is a solid body, absolutely transparent, and resembling in shape the lenses in an opera glass or telescope. Both of its surfaces, anterior and posterior, are convex, but the posterior one is at all times more so than the anterior. This lens is held in place by processes of the choroid coat of the eye, and its convexity is increased or diminished by the muscular processes mentioned, allowing of clear vision of near or distant objects.

In the space between the back of the cornea and the anterior surface of the crystalline lens, into which space the iris projects, there is a thin, watery fluid known as the *aqueous humor.* Should this be lost by any untoward accident it is immediately replaced by a new secretion of the fluid.

Back of the crystalline lens and completely filling the balance of the cavity, is what is known as the *vitreous humor.* This is a denser liquid than the aqueous and is contained in a very thin transparent envelope known as the *hyaloid membrane.* From the inner surface of this membrane partitions jut out into its interior in every direction, forming irregular, transparent wall cells, which contain the vitreous humor. Contrary to the case of the aqueous humor, should anything allow the loss of the vitreous, it can never be replaced, but is irretrievably lost and the eye is ruined.

The eye requires a very full and perfect supply of blood, and when it is deprived of this or is supplied with blood of defective quality, as in the case of a diseased condition of the rest of the body, the signs of the disturbance are clearly indicated to the trained

observer, or even to the casual onlooker, in the appearance of the organ. It loses its luster, its color changes and in other ways it gives evidence of the general lack of wellbeing. The eyes, furthermore, owing to the constant nature of their service, and their exposure to such great quantities of light (for the sensations of sight are the result of the chemical action of light upon the delicate materials of the surface of the retina, much as the photographic plate is affected by light), consume a tremendous amount of nervous energy, and in that way are closely related to the general condition of the body. Excessive strain of the eyes sometimes causes headaches and other serious nervous disturbances. They are such invaluable servants that we cannot take too good care of them.

The Ear.—The special organ of the sense of hearing is, like most other organs of special sense, double, one being situated on each side of the head. Anatomically considered, it consists of three parts, viz., the external, middle and internal ear.

Sound being the result of vibrations of air, the mechanism for hearing is so constituted as to receive these vibrations, concentrate them and transmitting them into the deeper portion of the skull, communicate them to the end-organs of the special nerve of hearing which carries them to the brain, there to be recognized as sound.

With this understanding we can more clearly comprehend the different portions of the mechanism of hearing.

The external ear consists of that portion which we see attached to the outer side of the head and the canal which leads from it inwards. The outer portion consists of the well-known shape attached to the surface of the head. This is composed of cartilage, more or less trumpet-shaped, and more or less convoluted and covered with skin. This apparatus is fastened to a bony ring on the surface of the skull, which is the outer limit of a bony canal, extending inward and forward for about three-quarters of an inch to terminate in a blank wall, formed by the drum-head. This canal is lined with skin continuous with the covering of the outer ear, but specialized by having glands in it for the production of so-called wax.

Around the margin of this opening, one finds a number of stiff hairs forming a perfect screen over the opening. The object of this waxy secretion and the hairy screen is the prevention of the entrance of insects and other foreign material into the canal.

The trumpet-shaped cartilage is called the *auricle* and is for the purpose of collecting and directing the waves of sound into the

previously described canal, which is known technically as the *external auditory canal.* Surrounding this auricle and attached to it are remnants or relics of muscles, which in the lower animals are freely used to give motions to this part. As an example, notice the motility of the ears of the horse.

The middle ear consists of an irregular, bony chamber situated in the temporal bone, having five walls of bone, and one of membrane. This membrane, the drum of the ear, is known as the *membrana tympani,* and forms the inner wall of the external ear and the outer wall of the middle ear. In the anterior wall of the bony cavity is an opening from which a trumpet-shaped cartilaginous tube leads to the throat, the broad end of the trumpet being in the throat. Through this tube the mucous membrane lining of the throat extends to and lines the middle ear. This tube is called the *eustachian canal,* and is for the same purpose as the small round hole which is placed in the side of a bass drum, that is, in order that the air pressure in both sides of the drum-head shall be equal and allow of proper vibration when this drum-head is struck. In the inner wall of this cavity are two small openings, one oval in shape, the other circular, and both covered with membrane. Thus we see that this middle ear has one communication with the air, viz., through the Eustachian canal to the throat, and is, therefore, filled with air. Crossing this cavity of the middle ear from its outer to its inner wall is a chain of minute bones called *ossicles,* attached loosely to each other. These ossicles are given names according to their shape, namely, the hammer, the anvil, and the stirrup. The hammer is attached at one end of the drum-head, at its other to the anvil, while the anvil is attached also to the stirrup, and the stirrup to the membrane covering the oval hole in the inner wall. To these bones are attached minute muscles, which make tense or relaxed this chain of bones, tensing or relaxing at the same time the drum-head.

The internal ear, or the innermost portion of the organ, consists of an irregular bony cavity—divided into three parts, the first portion, known as the *semi-circular canals,* three in number, occupy the rearmost portion. They are three tubes, half-circle in shape, about one-twentieth of an inch in diameter, placed at right angles to each other and one end of each joining with one end of another in a common opening.

The second portion of the internal ear is known as the *cochlea,* and forms the most anterior part of this cavity. It is somewhat

similar in shape to a snail shell, and consists of a circular gallery, which makes two-and-one-half turns in rising from the base to the peak of this snail shell-like cone. In this cavity, we find multitudes of fine nerve fibers, the end-organs of the nerve of hearing.

The third portion of the internal ear is a more or less oval-shaped cavity situated between the two spaces previously described, and connecting their cavities. This is known as the *vestibule*.

Lining the vestibule and the semi-circular canals is a closed membranous sac, of identical shape with the cavities, but much smaller in dimensions, so that there is a space left between the outer cavity. Within the membranous sac is a fluid, known as *endo-lymph,* while without the sac and surrounding it is a similar fluid, known as *peri-lymph.* This latter fluid extends also within all the spaces of the cochlea. Running in from this internal ear to the cavity of the skull is a small bony tunnel which gives passage to the auditory nerve or nerve of hearing, on its way from the ear to the brain.

When waves of sound impinge upon the auricle, they are first concentrated and then guided into the opening of the external auditory canal. Passing through this tube they pass upon the drum-head, causing it to vibrate in unison with them. The vibrations of the drum-head, the latter being connected to the chain of ossicles, cause them to move at the same rate and thus communicate identical motion to the membrane covering the oval hole in the inner wall of the middle ear. The vibrations of this membrane are communicated to the peri-lymph of the internal ear, are picked up by the nerve-end-organs in the cochlea, carried by the auditory nerve to the brain, where they are recognized as sensations of sound. The semi-circular canals are the special organs of the sense of equilibrium or balance and are concerned in every change of position of the human body. The disturbance of these organs, combined with that of the sense of sight, is mainly responsible for seasickness.

A local derangement of the ear, such as an injury to the membrana tympani, may not affect the health of the rest of the body. But at the same time, in case of disease of this part, a more perfect blood supply and a high degree of nervous energy will usually assist greatly in the process of cure. To a large extent the derangements of the ear are caused by catarrhal conditions, which extend first from the nasal cavities into the eustachian canal, and then, embracing the ear, give rise to inflammations and other trouble.

Smell and Taste.—Sight and hearing are made possible through

the remarkable structural mechanisms of their respective organs, but the senses of smell and taste are more nearly akin to the sense of touch. They actually feel the materials perceived by them, the foods directly, in the case of the taste, and the vaporous or dust-like emanations from them, in the case of the sense of smell. In this service, however, the nerves are infinitely more acute and delicate than those which "feel" through the skin. Through the olfactory nerves, when both the body and the organ itself are in a state of good health, we may discern the most subtle and refined of fragrances, and through the taste the finest shadings and variations of flavor.

The upper part of the nasal cavity is the seat of the organ of smell. Here the terminal branches of the pair of olfactory nerves spread out, their end-organs being found in the tiny peripheral processes of the olfactory cells placed among the epithelial cells of the mucous membranes, these end-organs thereby coming into touch with the air.

The tongue is a wonderful muscular organ, the organ of speech, taken in connection with the larynx and the vocal cords, but it is also the seat of the sense of taste. The mucous membrane of the tongue is characterized by multitudes of very fine processes, called the papillae of the tongue, of which there are several classifications. In some of these, the so-called circumvallate papillae, are the so-called gustatory cells, with tiny processes containing the end-organs of the nerves of taste. Gustatory or taste sensations are produced by the excitation of these bodies. In the tongue also there are other nerve end-organs which have to do with the sense of touch which is likewise located in the tongue. These are substantially the same as those of the sense of touch in the skin of the external body, except that there are very many of them here and this sense is very acute in the tongue.

PART 2

HEALTH FROM FOODS

THE human body and the foods eaten by man are of necessity composed of the same chemical elements, since the one is made from the other. This is strictly true if we class water as a food. Oxygen from the air also enters into living tissue but oxygen is also derived from food and water. The elements composing water, oxygen and hydrogen, are the two most abundant elements composing the living flesh. The next most important is carbon. The fourth important element is nitrogen. We do not get it from the air, though it is there in abundance, in the elementary form. Nitrogen, combined with the three preceding elements and very small proportions of certain minerals, forms complex substances known as proteins. Protein, combined with from two to three times its weight of water, composes all living tissues except fat and the mineral structure of the bones.

Fat, which is merely stored fuel, is composed of carbon, hydrogen and oxygen. The bones and teeth are chiefly made up of calcium phosphate, a combination of calcium, phosphorus and oxygen. In addition to the five mentioned, about a dozen other chemical elements also enter into the composition of the human body and must, therefore, be derived from food. All of these are minerals, and all are present only in small quantities. Because of the small amount of these minerals needed in the life processes their importance was for a time overlooked. More recent knowledge has shown this to be a grave error. For illustration, iron existing in the human body in proportions of only one part in 25,000, is none the less absolutely essential to life, since the hemoglobin, the oxygen-carrying substance of the red blood corpuscles, must contain iron.

The normal ratio of chemical body-elements is 65 per cent. for oxygen, 18 for carbon, 10 for hydrogen, 3 for nitrogen, 2 for calcium, and 1 for phosphorus. A fraction of 1 per cent. each of potassium, sulphur, chlorine, sodium, magnesium, iron and iodine is present, totaling thirteen minerals in addition to those of which only traces exist, these including copper, manganese, fluorine, silicon and others. Most of these elements are used as chemical compounds and not in elementary form

in the body. The reason for this is that few of these elements are of use to the body if taken in their elementary form. In breathing we can use the elementary oxygen of the air, but the body can make no use of nitrogen, even more abundant in the atmosphere. Carbon, iron and sulphur (and so on through the list), are examples of chemical elements that are of no use to the body in their simple uncombined form. Most of these food minerals cannot be utilized, even in their compounds, unless these mineral compounds or salts have previously been incorporated with the more abundant organic elements.

This combination of minerals with carbon, oxygen, hydrogen and nitrogen, which takes place in plant life, makes it possible for animal life, including man, to exist. Without the existence of plants all higher animal forms would perish. We, therefore, live on second hand food, which has gone through one life cycle. The carnivorous animals go a step further and secure their food elements third hand, through the previous life processes of plants and other animals.

Man can exist either by this second hand or this third hand process, or a combination of the two. Human food, composed of the substance or products of plant or animal life, is generally classified by the chemist as "organic," as distinguished from inorganic or mineral substance found in the earth. Man can utilize a few inorganic substances, of which air and water are the chief. He can also make limited uses of

Photo Underwood & Underwood, N. Y.

Tropical fruits included in the group are pineapples, mangoes, oranges and coconuts. The large round fruit at the foot is breadfruit.

a few minerals in their inorganic form, such as common salt. But for the most part man depends upon organic food and cannot utilize elementary or mineral substances.

As the various substances formed by the combination of chemical elements are exceedingly numerous, early food chemists attempted to classify them into a few groups and so simplify matters. The group names so chosen were "protein," "carbohydrates," "fat" and "ash," or "mineral salts."

Protein, as already explained, is the name not for a single substance, but for a large group of chemical substances, the essential similarity of which is that they all contain the chemical element nitrogen. In the early work of food analysis no effort was made to determine the exact nature of these proteins. In fact, the analysis was usually made merely by determining the amount of nitrogen present and calculating from this the amount of protein, on the assumption that proteins usually contain about 16 per cent. of nitrogen.

Two errors were made by the early food chemist in regard to protein. One was that of attaching undue importance to it as a food substance, and the other was in assuming that one protein was as good as another. Other than the water content, the body is composed chiefly of protein; hence it seemed that protein should be the most valuable food, and that its use in larger quantities would lead to better nourishment.

This proved to be an error because it was not fully realized that the chief function of food in the body was that of a fuel to produce heat and energy. For a rough illustration, we might liken the body to a boiler and engine that served the double purpose of heating the building and supplying power. The boiler and engine are made of iron. The fuel required is carbon (coal). Attempting to fire the boiler with iron would be absurd. Now the human boiler-engine can, in fact must be supplied with a limited quantity of the material of its construction, as it has the power of constructing itself in the growth or the "repair" of its mechanism. But its chief requirement is fuel for the generation of heat and energy.

Another error made regarding this group of substances collectively known as proteins, has led to many serious misconceptions regarding food values. As large quantities of protein were thought to be important, lean meat was formerly very highly rated as a food. The vegetarians, chiefly because of sentimental reasons, disapproved of the use of meat. But they fell into the grave error of assuming the need of

Photo Underwood & Underwood, N Y

Bananas and other forms of tropical fruits are included in this group, in which appears also the unicorn fruit. Among other fruits shown is the pawpaw, both in complete form and in cross-section.

so-called "meat substitutes," or vegetable foods particularly rich in protein. We now know that this was a double-barreled mistake; in the first place we need no meat substitutes because the meat diet contains entirely too much protein to begin with Secondly, vegetable proteins, particularly those of the legumes: beans, peas, peanuts, etc., are decidedly inferior forms of proteins and are only partly utilized by the living organism.

The second group of food substances, chemically considered, is carbohydrates The chief carbohydrates are starches and sugars. There are several forms of sugar differing only slightly in their chemical

composition. Carbohydrates form the bulk (60 to 80 per cent.) of all human diets of vegetable origin. There are no carbohydrates in animal foods except the sugar in milk. Carbohydrates are also the cheapest food substance. Grains are composed of from four-fifths to nine-tenths starch. Corn is the cheapest known food in the central and eastern United States. Wheat in the eastern United States costs nearly twice as much as corn and is still a very cheap food. Wheat at a dollar a bushel, if a man lived on it and ate it straight from the mill, would make the cost of living less than three cents a day. In some parts of the world, where corn is not grown, wheat is the cheapest food substance. In China rice, and in India millet are the cheapest foods. In Russia it is rye and in Germany it is potatoes. The potato, chemically, is practically the same as the grains—the difference being that it is in moist form, carrying about three-fourths water by weight, and being very similar in composition to a cooked cereal porridge, as boiled wheat or corn meal mush.

Without the development of the grains and cheap roots and tubers as the dominant elements of the human diet, the present population of the world could never have existed. These foods must therefore form a great bulk of the total human bill of fare. And this involves constant danger of improper nutrition because carbohydrates, though a good fuel substance for the human engine, do not supply the elements of the body's growth nor for its proper function. Starch and sugar are related forms and contain the same elements. In fact, sugar can be made from starch as is done in the case of glucose, which is a sugar made from corn-starch.

The third general group of food substances is fat. Some fat is essential in the human diet, as proved in Germany during the World War. A certain amount of fat makes the diet more palatable, and most of our modern cookery is based upon the use of fat to "enrich" other food substances. Yet fats and carbohydrates contain the same three elements: carbon, hydrogen, and oxygen. Their sole function in the body is that of being oxidized, or burned in our slow physiological fires, to produce heat and energy. The use of fat from foods to make the human body fat is not a case of physiological use but merely a storing of fuel food for later use. The difference between fat and carbohydrates is in the amount of oxygen present, or the degree to which the hydrogen and carbon have already been oxidized. Because the fat contains less oxygen it is capable of further oxidization, and hence a given amount of fat will create more heat and energy—two and

The cacao bean, here shown as it grows on the tree in the tropics, is the source of chocolate and cocoa.

a fourth times as much — as will starch or sugar For this reason fat is worth more per pound. Oil, at a price of eleven cents a pound, would be just as cheap as sugar would be at five cents

In a carnivorous diet, the carbohydrates being absent, fat becomes the chief source of body fuel Protein can also be burned, but it burns wastefully, leaving an unoxidized residue that must be excreted from the body, chiefly through the kidneys, a process which man is not as able to handle as well as the carnivorous animals.

The remaining group of food substances have variously been known as ash, minerals, or min-

eral salts. Most of these salts, in order to be available for human nutrition, must be chemically combined with the organic food elements. Thus, sulphur enters into the chemical composition of some proteins, such as egg albumin; phosphorus, on the other hand, is present in some of the fat-like substances of egg yolk. Calcium salts are a fundamental and very vital element in milk. The growth of the young animals, and consequent rapid bone formation, requires a large proportion of such bone-forming minerals. The fact that the calf grows faster than a child results from cow's milk being richer in protein and mineral salts than is necessary as a human food, even for the young. Hence, cow's milk may be diluted, or may form only a portion of the food of the child.

Mineral salts are present in varying quantities in foods of vegetable origin, but the proportion is greater in the leaves or other growing tissues than in those substances like seeds, tubers or pulpy roots which serve the purpose of food storage reservoirs in the plant's life and hence contain large quantities of starch or fat. Green leaves are especially rich in iron; spinach being richest of any known food in iron of a form that may be utilized by the human body.

Spinach, like other greens, provides only a small proportion of fuel food value. Yet it is valuable in the diet because of its high mineral and vitamin contents. The leaves of spinach and dandelions are especially rich in iron.

The usual tables of the chemical analysis of food give the percentage of protein, carbohydrates, fat, mineral salts and water. The proportion of the water is, of course, a very important consideration when estimating the value of food by the pound. For illustration, fresh fruit such as peaches contains about 85 per cent. of water and only 15 per cent. of actual food substance. But dried peaches contain about 15 per cent. of water and 85 per cent. of food substance. Hence, the latter, ignoring the question of the superior flavor of the fresh fruit, would be worth nearly six times as much per pound. Another illustration to show the importance of considering the water in food, is that of dry versus cooked cereals. A menu giving an item of "four ounces of cereal" if interpreted as the dry cereal, would have at least four times the food elements than if the dish be considered as meaning four ounces of the ordinary cooked cereal porridge.

There is no form of food table that indicates all elements of the comparative values of foodstuffs. Many factors must be considered and these will all be discussed later. Among those factors we would especially remind you of the matter of the weight of any food that one is likely to eat. The practical point of this will be seen by comparing milk and bran. Both are good foods for the average diet because both contain elements that the diet should contain at all times. But there is no table that will tell the weight of these two foods that one is likely to eat. Milk can be taken in huge quantities up to five or six quarts a day—that is, ten or twelve pounds: So taken it is quite fattening. Bran on the other hand is dry and airy and fibrous. One is not likely to overeat on it. In fact an ounce of bran is a good serving, two ounces a large serving, and it would be almost impossible for any man to eat a pound of it—or at least no one is likely to try to do so.

Therefore when you see milk set down as having 20 calories per ounce and bran as having 69 calories per ounce you are shown in figures that a given weight of bran is actually more nutritious than a given weight of milk; but the amount of bran any one is going to eat is decidedly limited, because of its bulk, and this changes completely the practical values of the two foods under discussion. Tables therefore apply only when equal weights of the foods are considered and have very different meaning with respect to the practical effects one would probably get from eating all one wanted of a given food material.

Certain facts about foods will enable you to judge how much or little they will add to the fattening effect of a diet. Of course there are no

foods that are positively reducing—that is, that will reduce you merely because you eat them, unless you pay some attention to the nature and quantity of the diet as a whole. The only sense in which foods are "reducing" is that they may contain so little fattening qualities that it is practically impossible to eat enough of them to maintain weight. Bran and leafy vegetables certainly come in this class.

Tables of food analysis also usually have a column headed "calories per pound." The calory is a unit of measurement taken from the physicist and is primarily a unit of heat. If a given quantity of food contains so many calories, it means that if burned it would give off so much heat. Most of our food is burned in the body; that is, oxidized, with the result that heat is always produced. A certain portion of this heat energy may be transformed into mechanical or muscular energy. But mechanical energy cannot be created in the living body, nor in the engine cited so often to illustrate bodily functions, without the producing of considerable heat. That is why we get warm when we exercise.

The use of the term "units of heat" is sometimes misleading. Heat and temperature are related but different things. The thermometer measures units of temperature.

A pint of water at a temperature of 100 degrees is twenty temperature degrees hotter than a pint or a quart of water at a temperature of eighty degrees. The number of degrees of temperature are not affected by the amount of water. Heat units do consider the amount of water and a quart of water at a given temperature contains twice as many heat units as a pint of water at the same temperature. It also takes twice as many heat units to raise the quart of water a given number of temperature degrees, and it would take twice as much fuel to heat it.

Body Heat.—The human body is always maintained at a temperature very close to ninety-eight degrees. Any departure from this temperature is a serious business—fever temperature rarely rises above 105 degrees.

The heat of the body is supplied by the oxidation or slow burning of the fuel foods. The amount of heat required to maintain the body at its normal temperature of ninety-eight degrees will depend on the temperature of the surrounding air, the amount of clothing, and the size of the body which affects the amount of radiating surface from which heat may be lost.

The evaporation of water absorbs heat very rapidly. And consider-

Photo Underwood & Underwood, N. Y.

This coconut palm tree is of the dwarf variety. The coconut is a source of vegetable fat.

able water is constantly being evaporated from the moist surface of the lungs and from the moist skin. The over heating of the body is prevented by the control of the amount of this evaporation. On a hot day, or when generating extra heat by muscular exertion, a man sweats, while a dog or a chicken "pants" to secure this extra evaporation. The degree of relief from this extra evaporation will depend on the humidity of the atmosphere.

The body is kept from getting too cold by the actual stimulation of extra oxidation, but this oxidation to generate extra heat seldom occurs with a man wearing the usual clothing

and exposed to the usual temperatures. The muscular action of heart, lungs, etc., ordinarily generates ample heat indoors or in hot weather, while out of doors in cold weather we instinctively keep the voluntary muscles active. Man, therefore, seldom needs extra food just to generate heat, as the heat produced during the muscular action is nearly always sufficient, and usually more than sufficient so that the excess must be taken care of by evaporation.

The calory measures the value of the food from the standpoint of its power to produce heat and energy. It takes calories to keep us warm and to make our muscles work. Moreover, we measure the fat-forming tendencies of food by calories, because fat in the body is derived from elements which, if oxidized or used as body fuel, would create heat and energy. Bodily fat may be derived either from fat or from carbohydrates or, somewhat wastefully, from protein.

Because the bulk of our food is utilized in creating heat and energy, or if taken in excess is stored as fat, we commonly consider the number of calories in the diet as the unit of measure of the *amount* of the food eaten. It is a somewhat dangerous method of food measurement, because it measures only one essential function of food. Thus out of the daily ration of two pounds of food, 80 to 90 per cent. may be utilized in the body for oxidation, and hence be measured correctly by the number of calories, yet the remaining 10 to 20 per cent., including the protein, is fully as essential to health and life as the more bulky fuel portion, the measure of which is expressed in calories.

Since fat and carbohydrates are utilized in the body in almost exactly the same way, and the essential value of both may be measured in calories, it was formerly thought that the statement of the number of calories and of the amount of protein was sufficient to give a true conception of the worth of a given food or of a given diet. By these two terms we may measure 98 or 99 per cent. of all the weight of the food substance. But the remaining 1 or 2 per cent., including the mineral salts and the vitamins, while insignificant in quantity, are still just as vital to life and health as the more than bulky portions. We can even go further and state that a single mineral or a single vitamine which in quantity may be less than one thousand of the weight of the food, is absolutely essential to life, and if "deficient" in a diet, its lack will cause quite as serious results as if the whole quantity of food was insufficient.

The term calories is of value in considering food from the quantity standpoint. We can form approximate ideas of the worth of food per

pound in the number of calories it contains. We can also intelligently discuss the total amount of food that should be eaten in terms of calories. But such considering of food quantity is only safe when the diet has first been properly selected and proportioned to make sure of the inclusion of sufficient variety and proper amount of the essential minor food elements. Unless these other factors are first considered the study of food in terms of calories is apt to prove a delusion and a snare. Thus calories alone will proclaim that one and a half pounds of starch or five-eighths of a pound of oil is a sufficient daily food allowance for a man. Obviously, neither substance, nor any combination of the two substances, would support life; though they would supply heat and energy, they would not prevent starvation because of lack of other food elements. In fact, it has been demonstrated that an animal will starve to death more quickly on such mere "fuel foods" than if undergoing a complete fast. The reason for this is that the process of digestion and the subsequent oxidation of the fuel food consumes the body store of these rarer food essentials and hence results in their exhaustion more quickly than when undergoing a complete fast.

This old-time chemical analysis of food as protein, carbohydrates, fat, mineral salts, and in calories per pound, is still valuable information for those who are also informed of other and more recent aspects of food science. But this mere chemical analysis taken alone is not of much practical use and has doubtless often been worse than useless. A little knowledge is a dangerous thing, and what the analytical chemist can tell of foods by consulting his test tubes and without studying effects on the living body, is only a little of the knowledge of foods that is available for us today.

The Physiology of Nutrition.—Broadly considered, all physiological or life processes relate to nutrition, and are affected, directly or remotely, by food. Digestion is most immediately and wholly related to food, since digestion is the process of converting food into those substances which then become the living tissue, or which supply the living tissue with materials for its activities. A second group of physiological functions or activities most directly connected with food or nutrition, includes the transformation of food elements in the liver, the distribution of these elements of food in the muscles, and the elimination of waste products of the body through the lungs and through the kidneys.

The process of digestion is primarily a chemical one, but there are also mental or nervous factors and physical factors to be considered.

The chemical process of digestion begins in the mouth and continues throughout the length of the alimentary tract.

The transformation which the food undergoes in the different digestive organs varies with the nature of the food. Thus the digestion of starch begins in the mouth and is checked in the stomach, but is completed in the small intestine. On the other hand, the digestion of protein occurs chiefly in the stomach. Fat is digested almost wholly in the intestines.

The chemical process of digestion is carried on by means of enzymes or ferments, secreted by the digestive glands. With these ferments, which are highly complex chemical substances, the digestive glands secrete simpler substances, the purpose of which is to give an alkaline or an acid reaction to the material being digested.

The saliva or digestive juice of the mouth is weakly alkaline and contains a ferment known as ptyalin, which has the power of converting starch into sugar. This may be demonstrated by the fact that dry bread, when thoroughly masticated, develops a sweet taste.

When the food passes into the stomach it meets the gastric secretions, the strong hydrochloric acid of which counteracts the alkaline effect of the saliva and gives the contents of the stomach an acid reaction. This acid, it seems, is necessary to enable the ferment pepsin to get in its work—dissolving the protein elements of our food. Digestion, in the stomach, is not completed, however, even for protein. The main function of the stomach seems to be to act as a warehouse to take care of our irregularly eaten food and to dole it out in a slow and carefully regulated stream to the more important digestive organ, the small intestine. During this period of temporary storage, a certain churning about and thorough intermixing of the food occurs. The chemical transformations, however, are of a preliminary nature. We are inclined to give the stomach more credit and attention because of its prominent part in appetite as well as in digestion, and because when overloaded it makes its presence known.

Shortly after the food passes into the small intestines, it encounters the very powerful digestive ferments secreted by the pancreas and also the bile from the liver. Other ferments are secreted from the walls of the intestines, the total effect of these secretions in the intestine being to give a strong alkaline reaction and to recontinue the digestion of both starch and protein as well as to commence and complete the digestion of fat.

This process of digestion continues throughout the length of the

small intestine which is also the chief organ of absorption of the digested food elements into the blood stream.

Digestion is nearly completed by the time the stream of material reaches the colon or large intestine. The function of this latter organ is chiefly that of retaining the unabsorbed material or food waste.

The changes which occur in the digestion of the various groups of food material are essentially as follows: Water, whether taken separately, or the water contained in moist food is absorbed without chemical change. This absorption of water may take place in any portion of the alimentary tract. Water drunk between meals is absorbed directly from the stomach. The rate of absorption of water will depend upon the degree of moisture of the food, or the amount of water drunk with it. If the food is eaten dry, water will be secreted from the blood to bring to the food a suitable liquid condition. It was at one time given as generally hygienic advice not to drink with meals. More recent investigation has shown that moderate drinking with meals aids digestion, provided the drinking of water or other liquid is not for the purpose of washing down foods and thus preventing sufficient mastication and salivation.

Next to water, the sugars are absorbed with the least digestive change. True fruit sugars undergo no chemical change for they exist in fruits in the same form as the sugar in the blood. Cane sugar (that derived from beets is chemically the same) is a more complex substance, which must be broken up into the simpler sugars such as exist in fruits or in the blood.

Starch is a still more complex substance, composed of the same primary chemical elements as the sugars. Starch is not soluble. In digestion it undergoes a complex process of being "hydrolized," which merely means that more hydrogen and oxygen, in the form of water, enters into chemical combination with the starch and so changes it into sugar. There are several steps of this change, the intermediate products being gum-like substances called dextrins. This process of the simplification of the starch molecule can be partly brought about by heat. This occurs in the toasting of bread, or more completely in the manufacture of zwieback. Certain manufactured cereals are similarly treated and are known as pre-digested foods. There is no evidence, however, that this partial performance of the natural digestive function outside the body is any advantage to a healthy man.

We were formerly taught that the human being could not digest raw starch; a view which seems rather absurd as it assumes that man is by nature a cooking animal. The moist cooking of starch does not

change it chemically but only results in the dry starch grains swelling up to a pasty-like mass. The result is that digestion may occur somewhat more rapidly, but undesirable fermentation may also occur more readily. Man has power to digest starch either raw or cooked, and difficulties which occur in its digestion are probably due to the use of too great a proportion of starch in the diet.

Another artificial process of "digesting" starch is by means of treating it with strong acids, as in the manufacture of glucose from corn-starch. Chemically pure glucose is a wholesome product, for it is indeed the same sugar that occurs in fruits and in the blood. The commercial product may contain common salt derived by the combination of hydrochloric acid and sodium hydroxide which are used in the process of converting the starch into dextrose. The prejudice against glucose as food is founded upon ignorance of its nature; it is a better food than raw starch of which it is made, or cane sugar which it replaces in the diet. The practical trouble is that the present-day civilized diet already contains too much food of this sort which crowds out other essential food elements. Hence, though starch, sugar, glucose, etc., are all good foods, their use should be discouraged as the tendency is to over-use them.

Though we do not list soap as an article of food—and only feed it to small boys who have been telling lies—yet a substance very akin to soap is found in food as an intermediate stage in the digestion of fat. Fat is insoluble, and hence cannot pass through the walls of the intestine, but fat treated with alkali becomes soap or is saponified, and in this soluble form passes through the intestinal wall; then the alkali is removed again and the fat restored, existing in the blood in the form of tiny fat globules.

The digestion of protein is a very complex process. Like fat, protein is not soluble, and hence it is broken down into its simpler ingredients known as amino-acids. There are a large number of these and they are not alike; the different combinations and proportions of these amino-acids account for the different kinds of proteins. This explains why all proteins are not of equal value for the nourishment of the body. These various amino-acids are recombined, after absorption, into the various proteins needed by the body. These may be like the proteins of the food, but are more apt to be entirely different proteins which have been made out of the food proteins but with the discarding of considerable portions of their substance. The amount of protein actually needed to nourish the adult is small, and that amount depends

upon the nature of the protein in the food. Some proteins taken alone will not support life at all. Gelatine is one of these, and for this reason it was formerly thought to be without food value. It is now known that gelatine has food value when combined with other proteins which supplement the particular amino-acids which the gelatine lacks.

Chemically considered, the processes of digestion seem to be exactly like similar processes which may be conducted by the scientist in his test-tubes. But into the chemistry of life processes a factor enters which does not exist in the laboratory processes. This factor is a nervous or mental one. We have long known that the sight, smell or taste of food causes the "mouth to water," but it is only more recently that scientists have discovered that the secretions of digestive juices are influenced in quality as well as quantity by such nervous or mental stimulation.

Still more remarkable, as it at first seems, not only is the secretion of saliva affected in this manner, but the secretion of the gastric juice is also affected by the offering of food to the senses, and before such food enters the stomach. Thus, if meat be held up before a hungry dog, the dog's stomach immediately begins the secretion of gastric juice—and a more acid juice is secreted than if the dog be offered bread. From such experiments we can reason that the entire process of digestion is very skilfully adapted to the nature and quantity of the food. Obviously the appeal of food to the senses has only a preliminary effect, and such adaptation by means of nerve stimuli to the secreting glands must go on throughout the entire process of digestion, as it does indeed throughout all physiological processes.

The practical application of such knowledge would seem to argue in favor of the simplification of the diet and of the use of foods in their more elementary or natural form. How these physiological instincts can adapt themselves to the highly artificial and complicated civilized diet is a mystery. Indeed, they probably do not adapt themselves completely, which is doubtless one of the reasons why the highly complicated and over-seasoned bill of fare is not as digestible and wholesome as a simpler diet derived from natural foods.

We are frequently told that appetizing foods and the enjoyment of our meals are conducive to good digestion and proper assimilation. This is unquestionably true, in so far as unpalatable food cloys the appetite and fails to bring forth the proper secretion of digestive ferments. It is also true that anger, intense sorrow, or other distressing emotions will check or even entirely stop the process of digestion. But this argument in favor of appetizing foods may lead to trouble, if it is used

to encourage us in the use of too highly flavored or over-seasoned foods. Such foods over-stimulate the jaded appetite, and result in over-eating. Obviously, such artificial flavors, which disguise the true nature of the food, can serve no good purpose in the adaptation of the digestive secretions to the nature of the food. But the worst feature of the use of over-seasoned food is that the man fed upon a highly stimulating diet loses the power to enjoy, and hence the power to digest simpler food. There is a very easy cure, however, for this condition, and that is genuine hunger. The over-fed gourmand, who has lost all power to enjoy his meals, and who would sniff contemptuously at bread and butter, can very readily develop an appetite for old boots when a wise Providence casts him adrift at sea in an unprovisioned boat.

A third factor in the process of digestion is a mechanical one. Our teeth are given us for the purpose of chewing food, but entirely too much of our civilized dishes have already been chewed by the grinding burrs of mills, or by the chemical processing of food factories. The result is that these ground-up, mixed-up and pre-digested foods not only discourage the use of our teeth and the accompanying process of insalivation, but a mass of food enters the stomach which is too finely ground and too readily soluble. In the natural process of digestion, the digestive solvents gradually chip off or dissolve the external portions of the food particles. But when food, instead of consisting of granules or solid particles of the natural food substance, is in a mushy, semi-soluble condition, the entire mass is attacked too rapidly by the digestive ferment, but the chemical process is not completed quickly enough. The result is that unwholesome fermentations, due to the presence of bacteria, occur. Such bacterial fermentation or decomposition may produce various toxins or poisons.

Similar undesirable fermentations with resulting developments of poisoning or auto-intoxication may occur, merely because the mass of digesting food moves too slowly through the intestines, or because the residue is retained too long in the colon.

The remedy for both evils is to be found in the use of coarser and more natural foods. The outer coatings of grain, most notably wheat bran, and the fibrous portions of vegetables, particularly of leafy vegetable, contain a woody fiber known as cellulose. This cellulose fiber is not digestible and does not ferment, but passes through the alimentary tract unchanged. The presence of such fiber increases the bulk of the food waste, especially in the latter stages of the digestive process. Man was fitted by nature for a diet containing a considerable

portion of such fiber, and when deprived of it, and particularly when all food has been finely ground or pre-dissolved, the result is that digestion occurs too quickly in the upper portion of the digestive canal, and the small undigested residue remaining fails to move along with sufficient rapidity. This is the explanation of the common civilized complaint of constipation, and the associated evil results of bacterial fermentation and auto-intoxication.

The functions of digestion thus far considered are generally understood because the subject is presented in the ordinary school physiology. But the processes of nutrition that occur after the food elements have been absorbed into the blood are not so commonly understood.

The function of the liver, we are told, is to convert the sugar, which

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FOODS IN COMMON USE CONTAINING PROTEIN

Protein is derived chiefly from animal foods. Examples of such foods here shown include meats, poultry, fish, fish roe, oysters, and cheese.

results from the digestion of all carbohydrate foods, into a substance called glycogen.

This reserve material may be stored by the liver in moderate quantities, and in this capacity the liver acts as a sort of temporary warehouse to store the fuel food as digested until it is required for the production of heat or energy of the muscles. Fat, which serves the same ultimate use, is not stored in the liver, but, if taken in excess of the body's immediate power to consume it, must be stored as fat throughout the various fatty deposits of the body. Either sugar or fat may be oxidized to produce heat and energy Moreover, when carbohydrate foods are eaten in excess of the body's needs, or the liver's capacity for temporary storage, the resulting blood sugar may also be converted into fat and stored in the fatty tissues, in the same way as fat derived directly

Photograph Bureau of Home Economics U S Dept of Agriculture

FOODS SUPPLYING PROTEIN

Milk and eggs, as well as many forms of fish and meat, supply excellent protein for human nutrition.

Sugar in the blood, and hence ultimately fat, can also be derived from protein foods when these are eaten greatly in excess of our needs. This is true because the protein molecule contains carbon, hydrogen and oxygen, the elements of both sugar and fat. But the protein also contains nitrogen, and sometimes other elements which cannot be oxidized or

burned. When protein is eaten in excess of the body's needs, a portion of it is thus wastefully used, the same as carbohydrates or fats, but the nitrogen is useless and must be excreted as a waste product. This excretion occurs through the kidneys in the form of urea. This disposition of excess protein must not be confused with the more normal use of protein, which is to build up the protoplasm of active cells and tissues. In the case of growth, such protein actually becomes a part of the living tissue. The individual cells are constantly breaking down and being replaced by others, so that there is a certain process of cell growth always going on, even in the adult. The protein that has gone through this cycle and become part of the living tissue, only later to be discarded, is ultimately disposed of in the same manner as the excess protein taken with food.

It is because of this fact that scientists are very slow in finding out the true protein requirements of the body. They formerly assumed that the amount of urea excreted by the kidneys indicated the amount of protein that the life processes really demanded. Hence their surprise and skepticism when it was discovered a few years ago that a man could live, and seemingly be the better for it, on from one-fourth to one-half of the amount of protein formerly thought necessary. The scientists had been particularly positive that the body required these larger amounts of protein, because, when the amount taken in the food was decreased to less than the accustomed figure, the result was that more nitrogen seemed to be excreted than was being taken in the food. They reasoned that this nitrogen must come from the living tissue, and that the man was therefore consuming himself, and would ultimately waste away and die of starvation. The error was in the fact that the observations did not continue long enough. The extra nitrogen being excreted was derived from a sort of floating surplus, and when this was disposed of the amount of nitrogen excreted was reduced, or, as the scientists say, the nitrogen balance was reestablished, and maintained on a lower level.

Excess protein is not only wasted in the sense that it is not utilized, but it wastes other food substances because it stimulates the rate of metabolism, or physiological change, and causes the rate of oxidation of the body to increase during its period of protein digestion and absorption. This effect of protein was only recently discovered, but it has now been shown that a man, after eating heavily of meat, will generate from 10 to 30 per cent. more heat for a period of six to eight hours after such a meal of meat than he would on an empty stomach.

Excess protein therefore wastes other foods, as this extra oxidation does not serve any useful purpose.

Some scientists still argue that there is an advantage to be derived in this wasteful and excess use of protein. These arguments, however, seem to be based upon the natural prejudice in favor of the maintaining of established habits. By the same line of reasoning, many people argue that the eating of all food in excess of our actual needs is a good thing, as it makes us "fat and prosperous" with a sort of surplus bank account of nutriment always on hand.

The fallacy of this view will be fully considered in our further discussion.

Five Rules for Eating.—There are five important points in regard to eating that should never be overlooked. First, *Never eat without a healthy, normal appetite-hunger.* Get rid of the idea that you must eat to keep up your strength. Unless you need food you are far better off without it. To eat three or four times a day because you are in the habit of doing so is a positive crime against the body, for nobody needs three or four meals a day, and to eat when you do not need it is to load up the body with a weight of material that, even if one got rid of it immediately, would require a considerable expenditure of energy. An excess of food is not easily disposed of. Nature endeavors to teach man the lesson of controlling his abnormal desires by making the excessive food a source of pain and discomfort to him. He suffers from flatulency, heartburn, acidity of the stomach, and a thousand and one other manifestations of indigestion, all of which are sentinel warnings against yielding to the unnatural cravings of abnormal appetite.

But it may be asked, How shall I know that my appetite is normal? The test of the normal appetite is this: that one is prepared to eat the plainest, simplest, most unattractive food without appetizing condiments, sauces or strong seasonings, flavors, or sweetening to make it palatable; to eat such food dry and chew it until it becomes delicious and perfectly liquefied so that it can be swallowed without recourse to water, tea, coffee, cocoa or any other liquid to wash down the food.

The second rule is of equal importance with the first. *Never eat without enjoyment.* Food, to be properly digested and assimilated by the stomach and the alimentary canal, must be enjoyed while being eaten. Contentment should always be present, and never more so than in the process of eating. When food is enjoyed the salivary

glands are active and the saliva mingles freely with the food. The gastric glands are active in the stomach and pour forth their liquids in copious quantities and in the best possible chemical condition to perform their important labors. Under no other circumstances are these digestive liquids furnished in the proper quantities, or the proper strength. We all know how one's mouth waters at the thought of some particularly palatable food. The actual necessity for a perfect digestion and assimilation is, that one should be in this condition of "watering of the mouth" before he begins every meal. Food eaten under these conditions is almost sure to be easily digested and assimilated, and can then produce that vigor of body and mind that the normal man and woman so much desire. If you have a craving for those things that you know are unwholesome, substitute for them some article of food containing the same constituents. For instance, if you have an intense desire for candy, it may indicate that you have a real need for sweets, and this craving can be perfectly satisfied by the use of honey or such naturally sweet fruits as dates, raisins and the like.

Third. *Never eat to repletion.* If one follows the normal hunger-appetite, there is very little fear that he will eat too much. But most of us have for so many years perverted our natural instincts of appetite, that it will take some time before we can rely upon appetite, unguided and uncontrolled by reason. It is better, therefore, to err on the safe side. There is very little danger, if a man enjoys every mouthful of food he eats, that he will take too little. The common experience of the race is that we eat too much. Hence, there need be little alarm that one will not eat enough. It is far better to stop before satiation than to eat one mouthful more than the body actually requires. Every ounce of food taken into the body beyond its normal requirements, even though it be eaten with enjoyment, is either creating a burden of fat or putting a burden upon the excretory organs to get rid of it.

The needs of the body vary according to varying circumstances and conditions. When the appetite is normal and healthy it will call for the food that is best adapted to supply the needs of the body. It will adapt itself to these varying circumstances.

Once let a man thoroughly understand and realize that the body is originally self-acting, self-regulating, and that it clearly indicates to the alert mind of its owner what are the exact supplies it needs, and he will be able, after he has once got into a normal condition,

to follow the dictates of his appetite with safety, and with most happy and beneficial results.

Now one should eat to live rather than live to eat. By following this policy you can actually increase your length of life from ten to forty years. Nearly all diseases begin in the stomach and most diseases continue in the stomach. This organ, when diseased, helps in the process of making impure blood, blood that contains all sorts of poisons. This vile stuff is sent coursing through the body, and yet people wonder why they are not well. In many instances they might more reasonably wonder why they are alive.

The average individual is of the opinion that one must eat three meals a day in order to keep up one's strength. This is a most erroneous and harmful idea. It is not what you eat that keeps up your strength, it is what you digest and assimilate. When you are in the habit of eating more than you need you will actually gain in strength by simply lessening the amount of food you eat. Simply try lessening the quantity of food you are eating by one-fourth, and then test your strength day by day, and you will find there is a perceptible increase. It will not be necessary to change your habits in any way, simply adopt this suggestion, and you will certainly be rewarded by an increase of strength if you are following the usual practice of eating three meals a day whether you need them or not. This result is gained because, when you are eating more than you need you exhaust the surplus energies in ridding the body of the needless food.

If one will learn to eat what he needs, is wise enough to avoid adding poisons to the body through the stomach, he will rarely suffer from chronic diseases. Many diseases develop from accumulated poisons and are the result of self-poisoning or auto-intoxication.

The fourth rule of diet is to *eat only food that is wholesome.*

Many foods popularly considered wholesome are quite the reverse. Of these, white flour products are perhaps the most harmful. It is certainly unwarrantable to call the incomplete food that is made from it the staff of life. It is more like the staff of death. White flour products, if eaten as the principal article of diet, will starve the teeth to death. Unless you possess extraordinary vitality, the teeth will often become mere shells under the influence of a white flour diet, simply because the bony elements needed to nourish the teeth are lacking. Remember, your teeth should last throughout your entire life. There is really no excuse for the decay and loss of teeth that is so frequent,

and it is largely caused by the excessive use of white bread and other deficient foods.

The fifth rule of diet is to *masticate everything thoroughly.* Food must be chewed thoroughly to secure satisfactory digestive results. Mastication is really a part of digestion. It mixes the food with the saliva. Each morsel of food should be masticated until swallowed unconsciously. Next to eating without appetite, perhaps the most serious food crime one can commit is that of swallowing one's food without chewing it.

Fast eating is one of the many vices of the American people. People dig their graves with their teeth by failing to use them.

Our teeth, like eyes and ears, were given us to be used. The more you use them and the better you use them, the longer both you and your teeth will last.

Digestion and Its Processes.—The work of digestion is really commenced in the mouth. If food is dumped into the stomach by a rapid bolting process, it is not in a fit condition for digestion. It should first be partly digested through the action of the saliva in the mouth. Thorough chewing is necessary to bring about the mixing of the saliva with the food. After it is thus treated, the stomach is able to take care of it without difficulty.

Wise men have known this for no one knows how long. Gladstone, the English statesman, made it a rule to chew each mouthful of food thirty-two times. This was a good way to secure sufficient chewing, but the amount of mastication should really depend upon the nature of the food. The best plan is to chew all food as long as there is anything left of it to chew. If you keep right on masticating until the food has reached the condition of a liquid, then you may be sure that it is ready to be digested easily and without difficulty.

Horace Fletcher taught that when food is reduced to a liquid through prolonged chewing, it would pass down the throat involuntarily, that is, without any conscious effort at swallowing. He found that by following this plan he could live on a much smaller amount of food than is usually considered necessary.

Thorough mastication is a true economy measure. It is not what one swallows, but what one assimilates, that gives strength. If a small amount of food, thoroughly chewed, is perfectly digested, one may get more benefit from it than from a large amount of food which is hastily swallowed and, therefore, poorly digested. Furthermore, there is a great waste of vitality in trying to digest and

assimilate food that is not properly prepared for the stomach. If you have but six minutes in which to eat, do not attempt to eat a full dinner, but eat what you can eat properly in six minutes. It is better to take just a little food and masticate that properly, and thereby assimilate it perfectly, than attempt to crowd your stomach quickly with unmasticated food.

Some people are naturally small eaters. Sometimes they are above the normal in weight. This is because of good assimilation. You may find others who are below weight, and yet eat more food than those who are heavier in proportion to their height. They do not digest what they eat. You can improve your digestion by eating only when hungry, and also by thorough mastication.

One of the advantages of thorough mastication is the greater enjoyment of food. If you like to eat, if you eat for the sake of eating, then, most of all, you should take time to chew your food. Chew each morsel and extract every trace of taste from it. In many cases, the longer you chew, the better the taste. Even if you eat less at your meal through this plan, you will enjoy it more.

Those who are accustomed to gormandizing, especially, will do well to heed the foregoing. Thorough mastication will probably do more to help one avoid overeating and obesity than any other practice. The normal condition of the stomach thus brought about seems to give one an instinctive impulse to quit eating when one has had enough.

Try to spend from half an hour to an hour at your meals, depending upon whether you are having a light lunch or a hearty dinner. Even liquid foods should be masticated, whether fruit juices, milk, soups, or what not. Milk, when taken by the young creature direct from the mother, is taken slowly, almost drop by drop. It is thus masticated, mixed with the saliva. One should never drink a glass of milk as one drinks a glass of water. It should either be taken through a straw, or sipped very slowly.

In the case of meats, prolonged mastication seems to be less important than in that of other foods. Carnivorous animals gulp their food. Saliva is not essential to digestion of meat, but masticating meat undoubtedly helps its digestion, for when it is ground into fine particles by the teeth before swallowing, the digestive juices can penetrate its substance more easily.

The temptation to neglect chewing is an ever-present one and is aggravated by our methods of preparation, wherein the miller's mill

and the cook's pot do practically all the chewing in advance. Some resolute persons have been able to establish the habit of chewing all food whether it needs it or not. But chewing cornstarch custard is too much like boxing with a ghost; many foods do not need chewing for mechancial reasons, and are yet of such a nature that, by reason of the chemistry of digestion, they should be chewed, or at least moved about in the mouth until sufficiently insalivated, before swallowing.

It is almost impossible, at least with the conventional raw materials, to make use of desirable combinations and cooking processes without getting a lot of these soft "chewless" foods. But you can, at least, provide some foods with every meal that will require a comfortable degree of healthy, natural chewing. This does not mean that the foods must be hard, or dry and dusty, or tough as rubber. Good, firm whole-wheat bread, dry or buttered toast, the firmer, uncooked fruits and vegetables, all require a natural amount of chewing. Nut meats require considerable chewing if they are to be completely digested. Natural uncooked grains require more chewing than man is equipped to give them, but boiled whole wheat, cooked until tender, or boiled rice, cooked Chinese fashion, with the kernels whole, and not made into a porridge, are typical foods that induce a natural and wholesome degree of mastication.

The foods most frequently undermasticated are porridges, puddings and other soft masses containing a large amount of starchy materials. If such foods are served, they should either be masticated deliberately, or eaten with other foods requiring real mastication.

Many will say, when told the necessity of mastication, that they have no time to perform it. It is a far greater waste of time to use up the energies of the body trying to digest and assimilate a hastily bolted meal than it would be to take the time required for proper mastication. For instance, if you have but a few minutes to eat, you will often gulp down a large quantity of food, and sometimes for hours thereafter you wish that you had not eaten that meal. Never eat a meal in a hurry. If you do, you are almost sure to regret it, unless you have a stomach of the ostrich character.

How Many Meals a Day?—In America the standard number of meals is three per day. In Germany, at least before the war, it was five, two of them served to workmen in the field or elsewhere. In England, the conventional number of meals is—or was—four. But the European meal is not so likely to be a full meal as the American.

Taken as a whole, a prosperous American is probably the most extravagant eater in the world.

The problem of the number of meals per day cannot be separated from the problem of the total quantity of food per day. Regular meal hours, insisted upon by many writers, find no foundation in the habits of animals or primitive man. Food was then eaten as it was procured, and varied widely in both quantity and quality. The digestive powers were much greater because of greater activity.

The food problem of the civilized and city-dwelling man is distinctly different from that of our primitive ancestors. The modern man's need for a less total food consumption, and for the stopping of his meal short of the point of repletion, are quite an obvious result of the change in the habits which civilization necessitated. But whether the civilized man who requires the smaller food intake should get it by eating frequently and lightly, or by eating less frequently, is a question which has not been definitely answered by the experience of races or individuals.

The three square meals per day of the American working man are perhaps not so dangerous, but it is dangerous when he continues to eat three full meals after he ceases to do physical labor. This tendency to overeat can most easily be combated by the individual whose general customs and social relations continue to set him down before the conventional three square meals, by the simple step of dropping out one of these meals.

If a man eat his fill he can sometimes get enough food in one meal a day to supply him with the necessary nutrition for light labor. But this filling the stomach up to its limit once a day results in a heavy load on digestion and frequently makes the hours following such a meal rather useless for anything else than the function of digestion. Therefore, we find little practical reason for adopting the one-meal-a-day plan.

But, if this quantity of food which the stomach can hold in one meal were divided into two meals, we would have a very practical and efficient amount for the digestive apparatus to handle, and yet would have the feeling that one had eaten a meal and not come away too hungry for comfort.

Inquiring among the readers of *Physical Culture* Magazine has shown that the adoption of two meals results in—first, a decreased quantity of food eaten; second, a marked improvement in health, resulting in both losses and gains in weight, according to the abnor-

mality; third, in the elimination of digestive disturbances, and the related ills due to the eating in excess of the bodily needs. The careful study of these reports leads to the conclusion that for both office and household workers the system of three meals a day, which has been passed down from our pioneer forefathers, is a mistaken plan.

The evidence, however, is not of such nature as would cause a careful thinker to decide that there is any inherent evil in partaking of food as frequently as three times a day. The benefits received from the change from three meals to two meals are more properly to be ascribed to the fact that it is a practical means to cut down the total quantity of food consumed.

The testimony of those who reported on the two-meal-a-day experiment in thirty-two instances stated the amount of food eaten showed a decrease of total food consumed; six reported no change in the amount, and three reported an increase. It is frequently emphasized that the dropping out of the breakfast or other meal has not resulted in increasing food consumption at the two remaining meals. The reports on the amount of the decrease in the amount of food taken range from "slight" to "more than one-half."

Less Intake of Food.—The average of the estimates of those who decreased their food intake was 26 per cent. less food consumed in two meals than was formerly eaten in three meals. Fifty cents a day is a low estimate for the cost of food. A saving of 26 per cent. would mean a saving of thirteen cents per day or forty-seven dollars per year one could save on food costs.

The economy of time is worth quite as much as the economy of food cost. Being obliged to be at a certain place three times a day and to "get the family together" if one eats at home, and the interruptions and difficulties involved in this third meal, are all absolute wastes of energy.

By cutting out the extra meal you can get that hour a day that you have been needing to devote to much neglected outdoor exercise or a course of reading.

But greatest of all savings of the two-meal-a-day plan is that it gives women an opportunity to escape from one-third of their kitchen labor.

Those who tried two meals a day in the test mentioned were chiefly from the lighter group of workers. Two-thirds at least were those whose work could be classified as clerical. Closely related in the nature of their physical labor were a number of school teachers, a couple

of college students, two traveling salesmen, a preacher, a doctor, a barber, a station agent and a weaver. The only men whose work would in any sense be considered heavy were an electrician, a physical director, a sailor, a chauffeur and three farmers. Among the women, over half were housekeepers. Others taking part in this experiment were teachers or clerks.

A few of those who had tried two meals a day made the comment that when engaged in extra hard physical labor they find it necessary to go back to three meals. With these exceptions there was almost unstinted praise for the two-meal plan.

The effect of two meals a day, which means refraining from over-eating, is that it tends to bring the body to normal bodily weight. That the same change in eating habits should make lean people fat and fat people lean sounds a little like the story of the satyr who blew on his fingers to make them warm and on his soup to make it cold. But we have not far to go for the explanation of this paradox. The fat man has a digestive system which absorbs surplus food and passes it on to be accumulated as fatty globules in the tissues. But when excessive food is forced upon slightly differently organized digestive organs, the result is a breaking down of the digestive powers, causing dyspepsia, and kindred ills, and these lead to malnutrition and underweight.

The period of rest that comes to the digestive organs from changing to the two-meal plan is secured both from a lessened consumption of food and a greater time interval between meals. The result is that better assimilation develops and when the subject is under weight this frequently results in building up weight.

The weight changes of these two-meal experimenters were studied by comparing the reported weights with the proper weights for the given sex and stature. It is found that the change to two meals a day resulted in gains (averaging eight pounds) for the men whose original weight would indicate that a gain was desirable. For the men who should have lost weight there was an average loss of thirteen pounds. There were a number of men who reported that the change in meal plan did not affect their weight. Those whose weights were not affected were found to be already very near the normal weights for their heights.

In this call for experiences with two meals a day, nothing was said as to which meal should be omitted. Twenty-seven report the omission of breakfast, five report the omission of a noon meal, and four

report the omission of the evening meal, while the four remaining report meal hours of midforenoon and midafternoon.

Practice is pretty evenly divided as to whether "dinner," in the sense of the heaviest meal, is to be eaten at noon or night. There were twenty-one who, when eating two meals, made the last meal the heavier. Against this were fifteen who ate a heavy dinner at noon and a light supper at night.

The reports of those who have tried two meals a day are almost invariably enthusiastic endorsements of the plan. The following are sample comments: "Much improved." "Do not feel so 'stuffed.'" "Tired feeling gone." "Did not feel so ambitious." "I feel invigorated, do not fatigue so easily." "In about one month I gained ten pounds and felt like a new man."

Many observers made note of greater sleepiness in the daytime when eating the three square meals. One comments: "The effect of going without breakfast has been to make my mind clearer, wide-awake. I found it easier to study in the morning—a feeling of mental vigor, whereas with three meals there is a feeling of mental drowsiness —general inefficiency."

Making Two Meals a Day Suffice.—The practical conclusion from all this is that two meals a day is the sensible thing for all those not engaged in heavy manual labor. If for social or business reasons the light worker cannot adopt the two-meal plan, the next best thing is to eat but one full meal a day. For that meal it may be safe to set an abundance of food on the table and eat to a point of reasonable repletion. But the other two meals should consist of definite items set forth in limited quantities. If one determines to breakfast regularly on half a grapefruit and two eggs on toast, the mind and the appetite soon become accustomed to such a restricted food intake and lose the desire to eat a square meal whenever one sits down to the table.

In eating three meals there is always danger that one will eat beyond his capacity to digest. It is impossible for one to know real hunger-appetite unless the food of the previous meal is digested and out of the way. The results that follow eating without this necessary hunger have already been pointed out. These can be avoided by seeing to it that each of the three meals is of easily digested foods and is small enough in quantity to enable the body to fully utilize it; but this requires both care in the selection of foods and self-denial in eating them.

It should never be forgotten that the more food one puts into the stomach above that which is necessary, the less effective become the gastric and other digestive juices. The result is, all the best elements of the food are not extracted for the needs of the body, and at the same time the residue ferments, creating poisons that are often absorbed into the blood, there to become sources of more or less serious disturbances. Very often the "tired feeling" experienced shortly after eating, or shortly before another meal is due, is entirely owing to the effect of the poisons generated by undigested food that the body has been unable to eliminate.

Those who do hard physical labor are better able to digest three meals than those whose work is purely mental, for in the destruction of muscular tissue caused by heavy labor there is a normal demand made upon the assimilative organs for whatever is within their reach. Mental workers, however, make no such demand, and the food must be digested in simple fashion or evil results are bound to follow.

The world at large has been trained to believe that regularity in diet and the eating of three meals a day are essential to keep up strength and preserve the body in perfect health. Neither habit is at all essential. Irregularity in diet is incalculably better than the regularity which forces men to eat three hearty meals whether the normal hunger-appetite exists for them or not. In the former case the most perfect health can be absolutely and certainly maintained. In the latter, there is no power known that can prevent digestive disturbances with their consequent discomforts and diseases.

If the conditions are such that it is necessary for social reasons for one to eat three meals a day, endeavor to follow with the utmost strictness the principles already laid down: 1. Eat only the right kind of food. 2. Eat only when you are hungry. 3. Be careful to eat less rather than more. 4. If there is the slightest suggestion of the approach of illness, miss one or more meals.

Drinking at Meals.—A much discussed question is whether or not the drinking of water at meals is advantageous from the standpoint of digestion. The answer cannot be given without considering the matter of thirst. Many people drink so much water with their meals that it is doubtful whether they are not more thirsty than hungry. If one is truly very thirsty and craves water, it is undoubtedly better to drink water to quench the thirst.

There is a once-popular theory to the effect that the drinking of water at meals dilutes the digestive juices and thereby interferes with

digestion. This conclusion is incorrect. The real trouble comes from the use of water, or other liquid, to wash down the food without sufficient mastication. As a result not enough saliva is secreted. Moreover, the act of chewing and the consequent secretion of saliva has been shown to stimulate the flow of the gastric juice, even before the food reaches the stomach. When a meal is washed down by water, the total secretion of digestive juices is therefore insufficient to meet the needs of digestion. The actual drinking of the water—if the act is separated from the swallowing of food—would not produce this effect.

When we eat food, and there is not enough water in the stomach to bring it to a proper degree of solution, the walls of the stomach secrete water, or a more watery gastric juice, which is the same thing, until the proper percentage of water is present in the stomach. On the other hand, when we drink water with our meals in excess of the amount required for ideal digestion, the surplus is quickly absorbed through the stomach walls and the food material again brought to a proper concentration for digestion.

From the above explanation you will see that the drinking or non-drinking of water with meals does not affect the condition of the food in the stomach so much as it does the water content of the blood. If the amount taken were excessive, the stomach contents would be somewhat affected, along with the blood and other body fluids. Under these circumstances, the body as a whole could not function at its best until the condition was corrected.

Experiments in the laboratory seem to prove conclusively that assimilation is facilitated through the drinking of water at meals. This would seem to indicate that not enough water had been taken in the intervals between meals. When there is a pronounced thirst, the addition of water increases the capacity of the digestive organs to accomplish their work.

Most of us do not drink enough water. Preoccupation with our work often keeps us from doing many things which would be to our advantage. It is not desirable to force down large quantities of water if one is not thirsty, but it is well always to cultivate what one might term a natural thirst. Every hour or two during the day take a drink. If you take enough vigorous exercise, engage in athletic pastimes, or do hard manual work, your pronounced thirst will drive you to drink—of course we mean water. But if you have a sedentary job, you are likely to neglect this practice. If you drink enough water

between meals, you will not feel the need of it so much at the table unless the foods eaten are exceptionally dry. In any case, you should follow the impulse of thirst at meal-time.

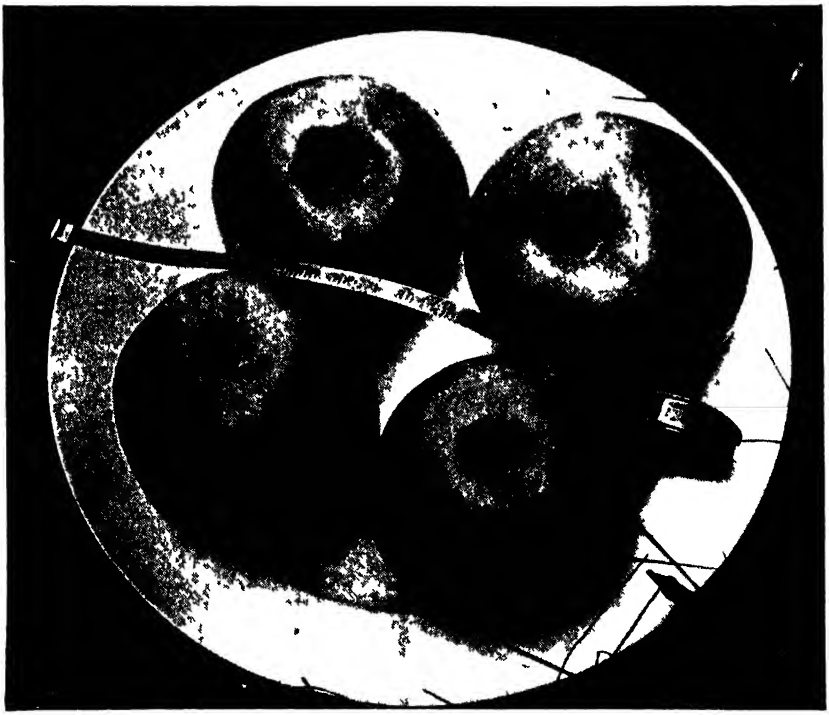
The temperature of the water we drink is another important matter. The ice-water habit is one of the typical American's greatest crimes against his stomach. If ice water were slowly sipped, as ice cream is eaten, it would not matter. The trouble is one gulps it down, and the result is a chilling of the stomach that is naturally detrimental to its functions. Some people can do it, and survive for a time. In other cases, it stops the digestion, produces headache, and brings about trouble generally. Water that is moderately cool is not only more conducive to the health of the stomach, but, when one becomes accustomed to it, more enjoyable than that which is ice-cold. Fairly cold water is refreshing under certain conditions, as on an exceedingly hot day, but even then it should not be ice-cold.

There is no question that the use of hot water before a meal is conducive to good digestion. In order to comprehend the reason for this we must consider the action of the stomach upon the arrival of water in that organ. If the stomach is empty, or practically so, and the water received is warm, the pylorus opens and permits part of the water to flow on through into the small intestine, thus aiding in its more ready absorption. As a result of this action the stomach is flushed out. Also, the warm water induces an increased flow of blood to the region. This is a good preparation for the arrival of food on the scene. Hot water may even be taken in connection with the meal, providing it is not used to "wash down" the food. The popularity of tea and coffee is due, not altogether to the flavor and stimulating effect of these drinks, but partly to the fact that they are served hot. It is largely because of the feeling of comfort brought about by a hot drink that they are so much used. But it would be ever so much better if people would use plain hot water; or what is sometimes called pink tea, consisting of hot water with a bit of cream and sugar; hot water and honey; grape tea, consisting of hot water with a little grape juice and sugar; or some other hot fruit drink.

Milk at Meals.—Milk is often used with meals, but it should be taken as a food, and not as a thirst-quencher. Milk contains water to the extent of seven-eighths of its bulk, but this water is in proportion to the amount required for the digestion of the milk solids—for Nature has fixed it so that the nursling animal, until it learns to

drink water, must receive its needed water through milk. Milk, therefore, furnishes its own necessary water content, and leaves no surplus for the liquefying of other food elements. Even the proportion of water found in milk is not always sufficient for the young, as babies and other young animals are found to thrive better if given additional water. The living body readily disposes of surplus water by excretion through the kidneys or skin, and there is far greater danger of too little than too much water.

Although the drinking of hot water before meals is by no means new, very few people have learned the value of drinking it after meals as an aid to digestion. If you have eaten a hearty dinner, the drinking of anywhere from one to three cups of hot water one hour or more after finishing the meal, or at any time after dinner that you feel thirsty, will help remarkably in the task of digestion and in assimi-



Apples, in addition to the good qualities they possess in common with most fruits, may be used raw or cooked. In the raw form, the apples contain an unusual proportion of cellulose which is valuable as a means of counteracting constipation. While this cellulose is lost in cooking, applesauce is considered one of the safest fruit foods for young infants.

lation. Here, again, the action is similar to drinking before meals, and stomach digestion has now proceeded to a point where it is advantageous to stimulate the forward flow of the contents into the intestine.

Raw or Natural Diet.—Although the human race has become habituated to the use of cooked food, yet it is probable that the best health can never be enjoyed except when a certain amount of uncooked food is also used.

The life-giving elements of food must be, to a certain extent, impaired or destroyed in the process of cooking. Chemical analysis in the laboratory may not disclose any essential change in the make-up of a certain article of diet; but there must, nevertheless, be some change in the value of the food, just as there is an undeniable change in its digestibility. Some foods can be digested when cooked which are very poorly digested in their raw state. On the other hand, there is no doubt that those foods which are palatable or digestible in the raw or natural condition lose something which is beyond the power of the chemist to analyze or ascertain when they are cooked.

Something in the way of scientific recognition of this fact has resulted from the discovery of "vitamins." No one as yet seems able to state definitely just what vitamins are. It is only known that certain foods have vitamins and others lack them, and that some vitamins may be destroyed in the process of cooking. It is a curious fact that foods which are the most edible in the uncooked form, including fruits, green salads, milk and eggs, have vitamins in greatest abundance. It may be that the mysterious and elusive elements or qualities, to which has been given this name of vitamins, have something to do with the vitality-giving quality of the uncooked, natural foods.

In actual practice it is found that the well-to-do classes, and these are usually the more healthy classes, eat a larger proportion of uncooked foods, such as fruits, nuts, salads, milk and milk products. Even a small amount of these foods in the diet seems to have a pronounced effect.

When living entirely on uncooked foods the results are invariably gratifying. One enjoys a high degree of vitality and energy. But it is often inconvenient to follow such a regimen, and when other foods are available the old and deeply-established cravings for various cooked dishes are likely to assert themselves. Nevertheless, in many cases of digestive trouble, fermentation, acidity and the like, a complete change for a time to a raw or natural diet is advantageous.

A person accustomed to hearty meals of cooked food will find that, after a meal of uncooked food, he does not experience the full feeling, or the feeling of satisfaction, that he is accustomed to. If he really prizes this satisfied or full feeling, he can usually get it under such circumstances by taking some warm drink, either warm milk, or a hot fruit drink, such as grape tea (grape juice, hot water and honey).

For the most part the combining of various ingredients and their treatment by heat in cookery will not affect the chemical elements. Fat will still be fat, and sugar will still be sugar, no matter how much they are cooked.

But in other cases the nutritive elements of the food are altered by cooking. The vitamins are among the elements which may be destroyed by the heat of cookery. Probably some of the proteins are also rendered less available to the body by the application of excessive heat.

Science may be able to tell us more definitely about these points in the future, but this much we know now: it is not safe to select a diet composed wholly of cooked and preserved foods. Some of the foods should be eaten fresh and uncooked, particularly in the case of fruits and leafy vegetables. We also advocate the use of some uncooked fresh milk, and, if you do not dislike the flavor, of some preparations containing uncooked eggs.

Most important of all is the use of uncooked green salads. Uncooked

This photograph shows dried black mission figs. Outside of the immediate districts where grown, figs are best known in their dried form.

green leaves, when added to the diet of animals that have been experimentally made ill by feeding them deficient foods, bring quick recovery. Whole raw milk, cream, or butter, often has the same effect, depending on the particular nature of the deficiency Since all these foods are excellent in the uncooked forms, it seems the height of folly not to use them in that form, to some extent.

An uncooked diet should not include foods which require cooking to make them palatable and digestible, such as beans. It should, preferably, include only those foods which are palatable, attractive and digestible in their natural state. A great many vegetables which are ordinarily cooked may be eaten raw. Carrots, turnips and others of this class, are really palatable in the raw condition. Practically all children delight in raw carrots.

Rolled wheat, oatmeal and other grains, may often be eaten raw with good effect. Grains used in this way are very palatable when

Red bananas are bulkier but of lesser length than the more yellow common variety. Both the red and yellow forms of this fruit are at their best when thoroughly ripe.

combined with dates or figs and served with milk or cream, or honey. One bowl of raw cereal of this kind may very well make up a part of one meal each day when on an uncooked diet.

For the protein supply of an uncooked diet one may depend either on nuts, or upon milk, buttermilk, cheese, or any combination of these that may be attractive. Three or four ounces of nut meats per day should be sufficient. Fruit may be used without stint, according to the appetite. Figs, raisins, dry prunes and other dry fruits may be highly commended as substantial and nourishing foods. Bananas may be placed in the same classification. Dates are almost ideal as a source of heat and energy. The combination of dates and nuts is very popular as a confectionery product, and should be rated no less highly from the standpoint of food value.

Green vegetables of all kinds, in the form of salads, may be commended. These are desirable only if palatable. Perhaps the best dressing for them is one composed of lemon juice and olive oil, half and half. If desirable from the standpoint of flavor, a little salt, or French mustard, or sweetening, may be used in this dressing.

Speaking of sweetening, the ideal food for this purpose is honey. Honey has less tendency to cause fermentation than ordinary sugar. It seems to be very easily and satisfactorily digested in most cases. There are very few people who cannot eat honey, or who do not enjoy it. It may be used as a sweetening for milk drinks, or drinks of any kind. It is the ideal sweetener to be used in the feeding of infants, in place of sugar, if anything of the kind is desired. To a large extent, of course, any desire for sweets is satisfied, when on the raw diet, by the natural sugar found in fruits, whether these be among the fresh, acid fruits, such as oranges, peaches, or pears, or the concentrated sweet fruits, like dates, raisins and figs.

Milk and buttermilk may be used freely in the uncooked diet. Cheese is especially attractive in combination with green salads.

Those who wish to try the uncooked diet can readily select dishes suited to their purpose. One of the advantages of the uncooked diet is that it involves less labor in preparation. Your common sense will tell you what foods are suitable for eating uncooked, and a little ingenuity and experimenting will show you the tastiest combinations.

Why We Need to Understand Calories.—No diet for any purpose can be intelligently considered until it is considered from the standpoint of both quantity and quality. In the early days of food science perhaps too much attention was given to the subject of measur-

ing foods for quantity or by calories. Now the tendency is to stress the subject of the quality of food, especially those vital qualities that come from vitamins and minerals.

Important as are these vital qualities there are many problems of diet that must consider food quantity. How much we eat is also very important. It is absolutely essential in all problems of weight control. It is a vital factor in the rate of child growth. When we consider matters of food economy, it is also necessary that we have some standard, other than market prices, by which to compare the real values of foods. Indeed, if actual values of foods were directly proportional to their market prices there would be no problem of food economy to solve, for there would be no opportunity to cut down the cost of living without cutting down the nutritive quality and impairing the efficiency of the diet.

By Bulk or by Weight.—It may help in the understanding of why a scientific system of food measurement is necessary, if we first consider the measuring of foods by bulk and by weight. Part of the business of food manufacturers consists in making foods bulk up more. Some of the feathery breakfast foods come in this class. Imagine the foods with which you are familiar all being sold by the quart, and prices established on that basis. Then suppose a rival grocer should start selling all food by the pound. Immediately the price of lettuce would go up and the price of molasses would come down.

The difference in the actual specific gravity of foods is slight, with the exception of molasses, not amounting to more than 10 per cent., oils being about that much lighter than watery foods. It is therefore easy for us to understand that "a pint's a pound the world around," except when the pint contains air. But as a pint of all dry granular foods contains air in varying amounts, weighing is obviously more accurate than measuring.

Whereas the amount of air changes the quantity of actual food when measured, so the amount of water present changes the actual food quantity when weighed. Watered milk, watered vinegar or watered oysters are obviously dishonest, because the water was added thereto by the hand of man. But if a dairyman could devise a method of feeding cows so that they would give milk containing twice as much water, the product would not be so patently dishonest.

Food weights are meaningless unless we take into consideration the amount of water contained.

Besides these differences in the air or water content, the chief fact

that makes one food more concentrated per pound than another is the percentage of fat. There is no such thing as the artificial concentration of food beyond the extraction of the water. One might as well try to concentrate iron or gold. But fat is a substance which is a sort of naturally condensed food, being equivalent in fuel value pound for pound to two and one-fourth times as much as any other food substance.

As the percentage of water and the proportion of fats are the chief reasons why the nutritive value varies for a given weight, it follows that the most variable forms of food are the meats which contain widely varying percentages of both water and fat.

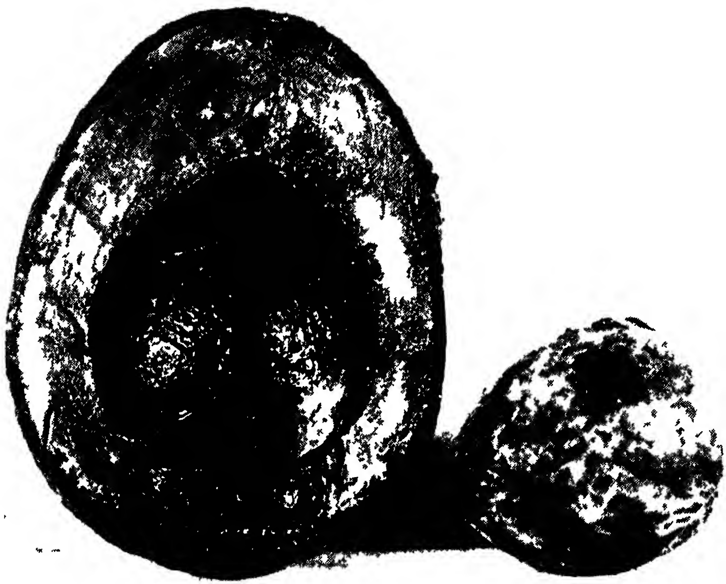
Combine both water and fat variation and the possibilities of variation in nutritive values is very great, as shown by the fact that a pound of oil contains about fifty times as much fuel value as a pound of cucumbers.

But before explaining the unit of food values, let us see what we are to measure. If cotton-seed oil has fifty times the nutriment of cucumbers, and cucumbers are worth ten cents per pound, the cotton-seed oil should be worth five dollars a pound. Yet cucumbers may sell for as much per pound as cotton-seed oil. This may be due to the fact that cucumbers taste good, or that people think cucumbers are good for them—though it may develop that cucumbers are bad for them. In short, there are many attributes that may affect the values of foods, other than the common quality by which we can measure them.

Of the functions that foods perform for the human body, the one that demands the greatest *quantity* of food is the supplying of the elements for oxidation, or as we commonly say, for heat and energy. It would be far better if the idea of heat were left out entirely, for heat is produced in the body as a by-product of the expenditure of muscular energy. Moreover, heat to the average mind means temperature, and the control of bodily temperature is a matter not greatly affected by the nature or quantity of food eaten, and hence the measure of food in heat units is misleading. In fact, in so far as the nature of food does affect body temperature, it has recently been found that protein (lean meat) increases it, whereas fat has hitherto been supposed to be a "heating" food, merely because one pound of it will last longer in supplying normal body heat without increasing body temperature at all. If any difference between lean and fat meat is to be observed, we should eat fat meat in summer and lean meat in the winter.

Heat and Energy Value.—Though the terms "heat" or "energy" are misleading if taken literally, yet the comparison of the total heat and energy value of foods is the fairest basis on which the cost of nutrition can be measured Foods serve many and varied purposes in the body; certain food elements are needed to keep our teeth sound, others to keep the bowels active, yet all such important physiological needs may be met with a small but properly selected diet, and yet starvation occurs from sheer lack of sufficient quantity of foods. But all foods—at least all natural foods—whatever else may be their special contribution to the body's needs, add to the supply of substance to be oxidized or burned up in the muscles to furnish energy and the resulting heat that keeps up body temperature. This use is common on all foods; it is the use that necessitates the most food, and, as it is a factor that can be scientifically measured, it has been chosen by all scientists as the logical measurement of food quantity and as a basis for comparing food costs.

The use of the calory as a unit of measurement has been mentioned This laboratory unit was at first determined by burning food in a special



The avocado, commonly called alligator pear, contains a larger proportion of fat than most fruits and vegetables. When fully ripe, the consistency of the pulp resembles that of butter.

apparatus to measure the amount of heat produced. Yet this heat unit or calory is most talked of in relation to food as it effects body weight. That is because the variable factor in body weight is fat and fat is stored body fuel.

The number of calories of food fuel required to maintain the body weight, varies greatly with each individual. To understand why this is so we must consider more carefully just how food fuel is used. It is literally a fuel, and is used for two purposes: the creation of heat and the creation of mechanical motion. That body fuel has these two uses is easily comprehended from the fact that it has the same two uses in an engine. The burning of coal in the boiler of the steam engine creates heat, but through the mechanism of the steam engine it also creates mechanical energy or motion. The same thing occurs in the gasoline engine.

Obviously, the boiler room of a power plant does not have to have an additional heating system; neither does the space under the hood of your automobile. In both cases the space is heated by the surplus heat from the combustion of the fuel that runs the engine. The same thing happens in the human body. The waste heat in the production of muscular energy is used to keep the body warm.

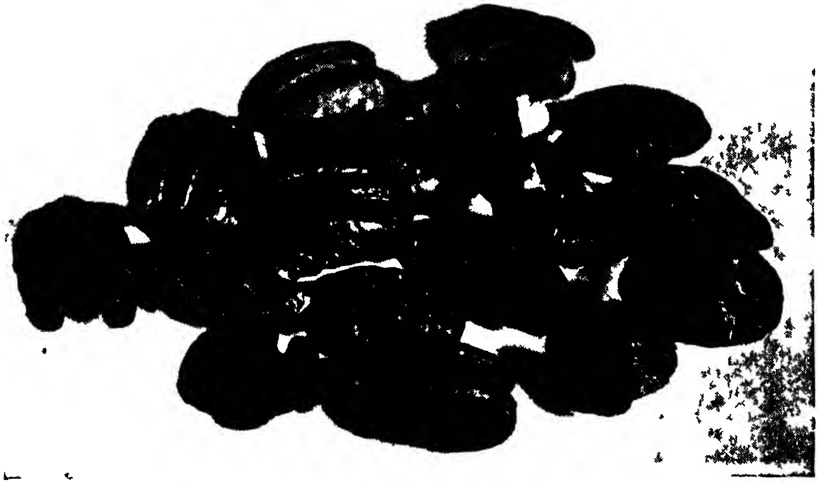
This fact is not commonly comprehended because few people realize how much muscular activity is going on in the body as long as life continues. The heart is a very active and busy muscle. It is in most persons as large as the muscles in their upper arm. If a man were to raise a ten pound dumb-bell by flexing his elbow seventy times a minute for twenty-four hours a day without a minute's rest this would perhaps approximate the muscular work done by the heart in pumping the blood through the body. The action of the chest in

The pecan considered as a source of fat ranks high amongst all varieties of nuts.

breathing is another continuous muscular labor There are less important muscular actions in the digestive tract. Moreover there are always certain amounts of tension and strain in the voluntary muscles even when we are asleep These increase when we awake, and are further increased by sitting up, and still further increased by standing. The hard work that a ten month old baby makes of the mere act of standing will illustrate that fact, but the adult does it unconsciously and hence hardly realizes the muscular work involved.

All the above muscular activities consume fuel which can only be derived from the food eaten or from the body store of fat, which of course came from food previously eaten in excess of the body's immediate needs. Whether fuel needs to be burned to create heat in addition to that burned to create muscular activity will depend upon the circumstances. If a ship in icy waters were to cut down the work of the engines to such a degree that the heat from the generation of steam did not suffice to heat the boiler room then extra coal would have to be burned to keep it warm

The swimmers who brave the chilly waters of the English Channel have a problem of conserving heat to keep warm in addition to the amount generated by their swimming action That is why they are coated with grease to check the loss of heat from the body. Yet because of their swimming they do generate more heat and therefore can resist chilling far better than could a nonswimmer that was merely

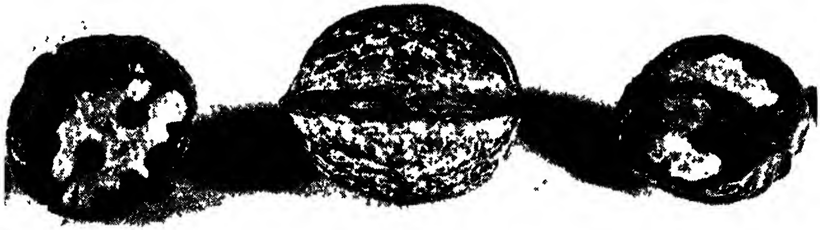


Nut meats of the paper-shelled pecan.

suspended in cold water clinging to a piece of wreckage. In ordinary life in temperate climates protected as we are from cold by houses, furnaces and clothing we have little occasion to burn fuel to keep warm but are kept warm by the surplus heat from the constant muscular activity I have described. Indeed our problem is more often to keep cool. In that respect we are like an auto engine with its radiator to keep the engine from overheating. As the water flows from the cylinders where the heat is being generated to the radiator where it is cooled, so our blood flowing from the heart and through the other heat generating muscles to the skin is cooled there. The rate of this cooling is chiefly determined by the amount of moisture that is evaporated from the skin. Thus the regulation of the sweat glands is our means of disposing of surplus heat and so keeping the body cooled to just ninety-eight degrees. It is a very sensitive and accurate control, and gets out of order only in the case of fevers.

An athlete on a warm day must sweat out vast quantities of water. A professional pedestrian doing his sixty miles a day requires about twenty pounds of water for this purpose. One method of pseudo-reduction depends on the trick of putting people on a scale and weighing them, and then putting them in a Turkish bath and causing them to sweat. Of course they show a loss of weight,

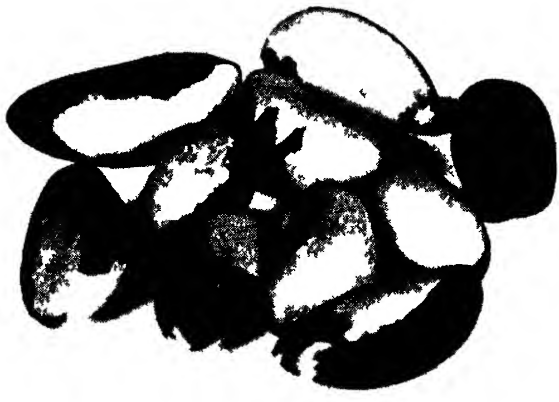
A shelled walnut is shown at left. Below are reproduced cross-sections of the walnut, with whole unshelled nut in center. Walnuts vary in composition. The cultivated or English variety has less protein than the black or American walnut.



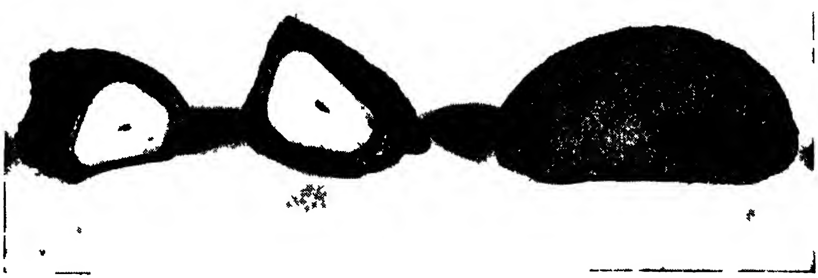
but it is not a loss of fat but of water, and such lost weight will all be regained as soon as the body thirst of the individual is again completely satisfied.

The processes of generating heat and energy described make up our normal fuel consumption. Measured in calories this will average about 2000 calories a day, when no particular exercise or physical labor is being performed

The exact amount of this fuel requirement depends on many factors. Among these are the size of the body. The effective size in this respect is not to be determined on the scales however in the case of fat persons. It is rather the stature, the size of the heart and other organs and the amount of muscular tissue that count. The actual surface area of the skin affects the fuel requirements since that determines the amount of heat lost from the body. The fat man has a somewhat greater skin area than the slim man and this fact



The Brazil nut has a high percentage of fat as well as a large protein content. The photographs show (above) shelled nut meats, and also (below) unshelled nut and cross-sections of a nut in shell.



tends to increase his fuel consumption. But on the other hand the fat acts like a blanket about him and tends to decrease the rate of heat radiation, and hence decreases his fuel requirement.

Also the fat man is usually poorly muscled, and slow of motion and lazy of habit, and these factors tend to decrease his fuel needs. A tall active thin man therefore burns more fuel and requires more food than a short inactive fat man, even though the latter may be a much bigger man as measured on the scales.

Women are smaller than men and also less active, and both factors tend to decrease their fuel requirements. These facts, together with others to be discussed later, result in obesity being more prevalent among women than among men. Women need considerably less food than men, yet since they eat with men they are tempted to eat as much.

Scientists in the past have wasted a great deal of time trying to establish diet standards telling how much food, as measured in calories, people should eat. The once famous Atwater standard published and sanctioned by the United States Government is as follows:

	CALORIES		CALORIES
Men at extremely hard work	5,500	Men at sedentary occupation or women at moderate work	2,700
Men at hard work	4,130	Men taking no muscular exercise or women at light work	2,450
Men at moderate work	3,500		
Men at light work	3,150		

The nut meats of the filbert are here shown. This is the variety found in the United States and usually known as the hazel nut.

Such tables gave the impression to the public that having enough calories was the only thing in diet worth considering, when as a matter of fact it is one of many things all of which are essential to life and health.

These stand-

ards are far too high and if followed lead to overeating, and that of course leads either to a breakdown in digestion or to obesity.

To go further, the terms defining the types of men according to labor are very misleading and vague and practically useless. It is true that there are men who work hard enough to equal these higher ranges of calory requirements, but such men are rare and because men like to flatter themselves that they are hard workers, any man consulting the table is inclined to place his own rating too high.

The matter of the size of individual men was not considered in the above statement, although some men are literally twice as big as others, not counting fat but only the weight of muscles and active tissue.

Finally, the basis of getting this data was unsound, as it was produced by observing how much men did eat when they were eating all they could. Of course portions of food wasted at table and elements not digested no doubt came in as errors of careless observation, but even when this is allowed for there still remained the gross error due to the average man's inclination to overeat when given a chance. Setting this up as a standard or ideal only meant perpetuating the common mistakes and weaknesses of men instead of leading them to ideal eating habits.

Other efforts at standardizing the calories of men's diet by occupations are equally absurd. Tables have been published stating how many calories farmers, carpenters, bookkeepers, seamstresses, etc., should eat, but they have all the chances of error pointed out above and some additional ones besides.

Of course scientists have pointed out some of these errors. But they frequently have only complicated things. They have shown how many calories per hour a man of a given size requires when sleeping, sitting, standing, walking, running, etc. Here are some figures from such tables, these being for a man weighing 154 pounds, and presumably not fat:

	CALORIES PER HOUR		CALORIES PER HOUR
Sleeping	70	Typewriting	140
Awake, lying still	85	Walking slowly	200
Sitting at rest	100	Walking	300
Standing	115	Running slowly	500

Attempting to calculate the body requirements from a table like this grows enormously complicated. In the first place the figures

would be different for each individual according to his exact size, and that couldn't be measured by weight because weight includes fat. Even assuming that one were of average build he would still have to keep exact account of the number of minutes he did each kind of exercise, and he would have to take into account various operations not included in such a list of activities. One couldn't even tell what was to be considered fast or slow walking, and if he guessed wrong on this it would make more difference in the estimate of his calory requirement than the difference between being asleep and being dead.

The last given table will serve one useful purpose, however, in that it will point out to you how very great a difference muscular activity makes in the calory requirements. This, of course, is very important in connection with exercise as a method of reducing. But in the present connection the point to note is what an absolutely confusing factor the exact amount of exercise is in any attempt to prescribe any given number of calories to cause a given person to maintain or gain or lose weight.

But while we can point out all the difficulties of attempting set dietary standards and saying just how much a man should eat, yet we cannot deny the fact that the amount of food he does eat as measured in calories is the factor that determines whether he will gain or lose weight. The difficulties here are the result, not of any uncertainty about the effect of surplus calories, but of our inability to tell how many calories a given individual actually requires. That is why many published diets, even if strictly followed, do not result in reduction for all people. This is particularly true in the case of women, because most of the experimental work in food science has been done with men, and most of the ideas of calory requirements are consequently too high for women.

Whether you overeat or not is a matter that relates wholly to yourself, and comparing your food with any standard or with that of any other individual does not prove anything at all.

Overeating.—We have been told repeatedly that we eat too much. The proof of the statement is seen when people who have hitherto given no thought to the quantity of food eaten decide to observe the matter of food economy as closely as they do their bank account. The outcome is that in four cases out of five the food intake is lowered, and genuine improvement in personal efficiency results. Money is saved and health is gained, the business of living shows double profits, just as when a man makes a change in his farm or

factory management that cuts costs and at the same time increases income.

The conclusion that the majority of civilized men eat too much may be reached either by a process of general reasoning, or by the observation of individual experiences. The wild man, along with the wild animals, was endowed with an appetite and food receiving capacity far in excess of what would be needed three times a day. Food in the jungle was available by fits and starts, and the meal hours were irregular. The man with the greater appetite and food capacity had a better chance of surviving unexpected delays in the meal hours than did the man of dainty appetite. Hence our instinct as to the amount of food to be eaten is often wide of the mark for present-day conditions.

So today, at least among all of us, save those engaged in heavy muscular labor, the tendency is to overeat. Especially is this true of the man who in earlier life was devoted to athletic sports or engaged in heavy muscular labor, and who, upon changing to a more sedentary life, prides himself on his former capacity for "three square meals a day."

But the most convincing proof of the universal tendency to overeat is the vast number of those who have deliberately cut down their food quantity and gained better health thereby.

Food, when taken in excess of that consumed by the activity of the body, is disposed of in one of three ways. The first and most direct way is by indigestion. The excessive food simply refuses to digest completely and is passed out through the bowels. Once the food is absorbed from the digestive tract there is no way that it can be eliminated from the body, except it be burned up by oxidation. If the food once digested is not burned up, only one other thing can happen. It must be deposited in the body as fat.

The conclusions from the above statements of physiological science are obvious and positive. If we overeat, and do not exercise to use up the surplus, we will get indigestion or get fat. Hence overeating leads to either dyspepsia or obesity, and sometimes to both. Thus we see that the control of body weight becomes a matter of the control of the intake of the food in relation to the amount burned up by muscular activity. If we would get fat we should increase the food and cut down the exercise. If we would lose fat we must decrease the food and increase the exercise. But note this, that few people desire to get fat. Those who wish flesh usually mean that they want to get

flesh over a bony form, and that the flesh desired is muscular tissue, not fatty tissue. Hence, in practice, we exercise to gain weight, and we exercise to lose weight, which seeming contradiction is absolutely scientific and proper.

Dietary standards are measured in calories. Standards were first arrived at by getting the facts as to how much food is consumed to gratify appetite and not for actual physical requirements. For years such standards were published by the government and generally accepted by the scientific world. This conception of dietary standards was based upon the reasoning that all men should do what the average man does.

In the table below is given a list of dietaries based on investigations of the foods eaten by men when free to eat what they enjoyed eating, or what they could afford to eat. From similar investigations the Atwater or government standard of dietaries was arbitrarily derived.

In recent years a change, in which physical culture has been a leading advocate, has occurred in favor of lighter dietary standards. Now we would make the standard dietary an ideal dietary and not merely an average dietary.

	CALORIES	LBS. OF WHEAT
United States: Men at hard, muscular labor	6,000	3.6
Athletes	4,500	2.7
Men at moderate muscular labor	3,425	2.0
Men not employed at muscular occupations	3,285	1.9
Ireland: Workingmen	3,107	1.8
England: Workingmen	2,685	1.6
Germany: Workingmen (hard work)	3,061	1.8
Japan: Laborers	4,415	2.6
Professional men	2,190	1.3
China: Laborers	3,400	2.0

Scientific work, recently conducted, enables us to determine such standard dietaries that are based upon the study of the ideal food intake rather than upon the average. This new standard dietary is not to be accepted as an absolute standard, but only as a basis to work from, for we now realize that there can be no standard applicable to all men, and that each individual must work out his own dietary

standard, as affected by season and climate, stature, age, occupation, the degree of muscular activity, sex, and lastly the weight or proportion of fat.

Protein Requirements and Vegetarianism.—Protein is distinctive from all other food elements in that it is the chief substance or rather the group of substances from which the actual organs and tissues of the body are formed and repaired. The other great groups of food elements, the starches, sugars and fats, can only supply heat and energy or go to form body fat. For this reason, since the early days of food chemistry, the protein group of food substances has always been conceded to be of especial importance.

Ancient Faith in Protein.—For many years protein was generally thought to be the source of muscular energy, for the reason that the muscles are composed of protein. This belief has been known to be erroneous for half a century, yet it had a hold, even upon the scientists, who had difficulty in getting away from the idea that a hungry, hard-working man must have meat to keep up his strength.

The food chemists of our colleges formerly taught that a diet relatively rich in protein was the diet for strength and endurance. As a result the athletic training tables at one time were heaped high with juicy beefsteaks, ham and eggs, and milk and cheese. Faith in these ideas was disturbed when Horace Fletcher, a retired college and business man, appeared at Yale University and asked to be subjected to strength tests in the gymnasium. Mr. Fletcher at that time was in his fifties, yet he broke strength records made by the young and vigorous athletes of the university. His endurance was far greater than that ever before recorded for a man of his age. Without previous training he was enabled to undergo the most severe ordeals without any of the resulting muscular soreness that commonly follows such tests.

Mr. Fletcher ascribed his superior condition to his eating habits, the chief distinction of which was that he practiced exceedingly thorough mastication and had developed his sense of taste until his food selection was very different from that of the conventional American bill-of-fare. An investigation of Mr. Fletcher's diet showed that he not only was eating a great deal less food than was supposed to be essential to health and strength, but that he was also eating a smaller proportion of protein, about forty grams a day, whereas the dietary standard then taught called for 150 grams for an athlete.

Professor Chittenden of Yale became so interested that he conducted

a series of researches which gave most remarkable results and seemed to indicate that protein, instead of being of greater value for strength production than other foods, was an actual detriment, and when taken above the necessary minimum is prone to increase fatigue and lessen endurance.

This revolution in the conventional dietetic teachings was seriously and stubbornly questioned by the orthodox scientists. The Danish government took particular pains to investigate the subject and gave Professor Hinhede a laboratory for such research. Hinhede not only confirmed the conclusions of Fletcher and Chittenden, but went even further in the reduction of proteins and showed that a man could live and thrive for months upon a protein intake as low as twenty to thirty grams per day, not quite equal to four eggs.

These findings in favor of low protein have not been wholly accepted, but practically the entire scientific world has conceded that the former dietetic standards were wrong, and that a much lower rate of meat consumption is desirable than was formerly considered necessary. This faith of science in the lower protein standards had a very practical application in connection with the World War, enabling the warring governments to feed their people upon a diet containing a much smaller proportion of meat and dairy products.

The question of the amount of protein is, in practice, the question

The use of the flesh of the turkey as food is an example of the wasteful cost of some forms of protein.

of heavy meat eating and is complicated by the fact that meat foods are highly flavored and that people like these stimulating flavors. Because such foods are expensive to produce and taste good, the rich, prosperous people, whether individuals or nations, consume more of these foods than their poorer brethren.

Meat-eating races, that is, the rich, well-fed of the earth, have been the successful, domineering sort. The poor ape their betters and strive to adopt their habits. The prejudice in favor of meat, backed up by its good taste, has kept alive the notion that the protein foods, especially those from the flesh of animals, are of particular value and potency.

Protein in Excess Harmful.—Protein substances are not altogether different from the other foods. In fact, three-fourths of the weight of protein foods are composed of the same basic carbon and hydrogen compounds that form starches and sugars. When protein is eaten in excess of the body's needs, it is separated into simpler components, and the fourth of it which contains the element nitrogen is discarded and excreted in the urine, while the remainder is utilized as starch and sugar are utilized to create body heat and energy or be converted into fat.

This process of discarding part of the protein eaten in excess of our actual needs is now known to be physiologically harmful. Certainly it represents a great economic waste, for not only is the substance wasted, but it is substance that costs five to ten times as much as the substances which it only partly replaces. Both economy and health here argue to the same end—that we should eat only as much protein foods as we need, and that to eat more is foolish, if not actually harmful. Eating excess of protein is like burning the furniture to warm the house. There are better and decidedly more economical foods. This is especially true of certain animal products.

This question of how much protein we should eat is very important to the man who would cut down the cost of living—as important as would be the question of getting coal if one were heating his house by burning tables and chairs. If you want to save money, patronize the butcher less and the vegetable man more.

The dietetic teachings now advocated as the "low protein diet" are closely akin to the vegetarian theories. Vegetarians have always shown up well in athletic competition, especially where the event depended upon endurance. In long-distance races, in America, England and Germany, the percentage of vegetarians who finish in the lead has

always been greater than the percentage of winning meat-eaters. Professor Irving Fisher of Yale put this matter to a definite trial by taking the number of simple endurance tests of vegetarians as against meat-eaters; the resultant showing for the vegetarians was highly favorable to their claims.

A strange inconsistency on the part of vegetarians is the idea that they should have "meat substitutes." If the elements of meat are not needed why have meat substitutes? It is hardly fair to accuse the leaders of the vegetarian movement of thus deliberately condemning their own doctrines. It is a more likely explanation that this idea of the need of meat substitutes was adopted by the general public who believed there was something good in both theories and that by eating meat substitutes they would gain the benefit supposed to come from meat and sidestep its evil effects. This idea was undoubtedly strengthened by the former belief that large quantities of protein were essential to a healthful diet. We now know that this belief never had a scientific foundation, and that modern evidence indicates that it is exactly opposite to the truth.

The vegetarian in opposing the excessive use of meat agreed with scientific truth in a rather unscientific way. But in practice it is not wise to omit the animal proteins altogether. In modest quantities, preferably from milk and eggs, they are desirable if not actually necessary, and for giving taste and flavor they are essential for us who have been so long accustomed to eating them.

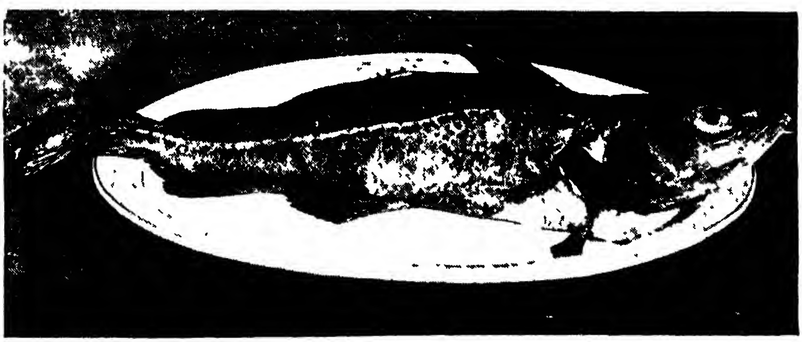
Nearly all vegetable foods in their natural forms contain small proportions of proteins. Were it not for this fact, life upon this globe would be impossible, as all animals would then have to eat each other —a very difficult state of affairs. The true vegetarian animal has a larger digestive apparatus than man. Vegetarians get around this fact either by advocating large quantities of nuts in the diet, or by meeting the meat-eater half way and including milk and eggs and tabooing flesh foods.

Only a small percentage of Americans are vegetarians by conviction, and the complete adoption of vegetarianism usually involves fears about getting enough protein, and especially about getting the right kind of protein. Animal proteins are the right kind, if not eaten in excess, because the needs of animals are very like our own. Milk and eggs, being created in the scheme of things for the express purpose of nourishing young life, are the best of all, and an effort to exclude them from the diet, especially the diet of children, is unwise,

Quality Variation in Protein.—One of the serious errors of the former chemists was the considering of all protein as of practically equal nutritive value. While it has long been known that proteins were highly complex chemical substances of many different sorts, the chemists were until recently unable to analyze them. In fact, the percentage of protein given in the old food tables was not determined as protein at all, but the chemist merely determined the amount of the element nitrogen and estimated the protein by multiplying the amount of nitrogen by a figure derived from the average percentage of nitrogen in the various proteins.

More recent chemical investigations have not only resulted in distinguishing a great number of proteins, but in also determining the more elementary compounds that go to make up the individual protein. To show how complex is the chemistry of these food substances we may consider first the total protein in a given natural food. This is again divided into various individual proteins; for instance, milk contains casein and albumen, wheat contains, among others, gliadin and gluten, while eggs contain albumen and ovovitellin. Each of these particular proteins is again composed of numerous substances known as amino-acids. Some eighteen or twenty of these amino-acids have been chemically isolated and the approximate proportion of each in the different proteins determined.

Proteins are not absorbed from the digestive tract as such, but are broken down into the various amino-acids which then pass into the blood in these simpler forms. From the blood stream carrying amino-acids in varying proportions the cells of the body select those needed to build the various proteins. As the body proteins are also very



A small codfish, dressed for cooking. From the liver of the cod and other fish iodine as well as vitamin A may be obtained for the human economy.

numerous and complex, we see the reason that the amino-acids from different food proteins will not be supplied in the exact proportions the body requires. Moreover, the requirements for protein building material will vary according to the demands of the body as determined by the various stages of growth and functional activities of the individual.

From this brief sketch of protein chemistry it will be seen that we may expect that some protein foods will be so composed as to supply the bodily needs with but little waste, while with others a large surplus would be required in order that the human cells might find the exact ingredients needed for growth and activity. Moreover, since all proteins do not contain all the amino-acids, it is likely that some would prove wholly deficient and incapable of completely nourishing the body or sustaining normal growth.

All the above theoretical assumptions have been demonstrated by feeding experiments upon animals. The most important protein in corn kernel is zein, which substance is lacking in three amino-acids that are commonly found in the proteins of living animal tissues. On the other hand, the proteins of beans and peas seem from chemical analysis to more nearly approach those of animal tissues. But the chemical knowledge is not sufficiently accurate to enable the chemist to anticipate what will support

The domesticated duck, used throughout the world for protein, is, like the goose, noted for a larger proportion of fat than other varieties of poultry.

protein metabolism in the animal body, as revealed by the fact that corn protein proves a better source of growth than that of beans and peas. An account of an actual feeding test will show how such facts are determined: Rats were given a diet complete in every respect as to fats, carbohydrates, salts and vitamins. To such a diet the protein from a single food, and that only, was supplied, and from experimental trials the amount of protein necessary to just maintain the weight of the animals is determined.

The following percentages of protein from various foods were found to be just sufficient to maintain body weight.

Milk	3	per cent. of the entire food
Oats	4.5	" " " " " "
Millet	4.5	" " " " " "
Corn ...	6	" " " " " "
Wheat ..	6	" " " " " "
Rice	6	" " " " " "
Flax	8	" " " " " "
Beans ..	12	" " " " " "
Peas ...	12	" " " " " "

A similar experiment was conducted with young pigs. But in this case protein from the various sources was supplied in reasonable abundance and the amount retained in the body, or utilized for growth, was determined. The pigs utilized:

20	per cent. of the corn protein
23	" " " " wheat "
26	" " " " oat "
63	" " " " milk "

The striking thing about both of these experiments is the very great superiority in nutrition of the protein from milk. This result, however, is perfectly logical because the milk proteins were built up for that specific purpose of furnishing material for growth, while the proteins in plant substances as well as the protein in meat are created to serve other functions than that of the nourishment. The superiority of milk as a food is not confined to its protein content alone, but its mineral and vitamin contents are equally efficient.

Scientists have not made final investigations of the relative value of protein from all food sources, nor can the investigation upon other species of animals apply absolutely to the human nutrition. We can, however, derive certain principles from the investigations thus far made that will be of use in determining the approximate value of

protein from various foods. Milk as already clearly demonstrated heads the list for the efficiency of its protein. A close second is eggs. Next in value we may expect to find the proteins of meat.

All vegetable proteins from all classes of food seem clearly to rank as inferior to animal proteins. This is a conclusion of modern science that does not uphold vegetarianism, and thus seems opposed to the discovery of the small amount of our actual protein requirement, which did uphold vegetarianism. However, there is no real conflict here. The practical conclusion would seem to be that the very best type of diet would be a vegetarian diet with the use of meat occasionally or its regular use in small amounts. Such diet would indeed seem to be preferable to the old style vegetarian diet, with its large servings of complicated meat substitutes, giving excess protein of poor quality, instead of minimum protein of good quality.

But it should be further noted in this connection that nothing in science contradicts the beliefs of the vegetarian who espouses this diet not from nutritional arguments but from an objection to slaughtering animals for food. He may eliminate meat entirely and by using milk, eggs and cheese gain all the nutritional benefits from the efficient animal proteins, while using no flesh foods.

Relative Value of Vegetable Protein.—The relative value of vegetable proteins is a point upon which we still need more light. The present information would indicate that oats rank higher than wheat, and wheat higher than corn. But a more important discovery is that the leguminous foods (peas and beans) have in the past been generally overestimated as a source of protein. This use of legumes was formerly endorsed on the grounds that they were meat substitutes, a view in harmony with the old belief that a large percentage of protein was essential to the diet. Our modern knowledge of the smaller amount of protein required, together with the later discovery of the lesser value of these proteins, would indicate that this use of vegetable meat substitutes is uncalled for. This does not mean that the leguminous foods are harmful, but merely that they add no great value to the diet. The fact that they are richer in flavor and that our habit of using them as "meat substitutes" may justify but it does not necessitate their continuance in the diet in their accustomed place.

A further teaching from the recent scientific discoveries regarding the composition of proteins is that a mixture of proteins from various sources will often make good the deficiencies of the proteins from a single food. Hence, as a general principle, we may conclude that the

protein requirements on a mixed diet would be less than that of a more limited diet. For illustration, gelatin was formerly said to be of little nutritive value, as it had long been known that it was not a complete protein. While gelatin alone will not support life, it is found that the addition of gelatin to a diet containing only the protein from a single grain will greatly increase the growth supporting power of the grain protein. The proteins of a combination of grains are also found to be better than those from any single grain of the group.

Not much is yet known of the quality of protein from vegetables, though those from the potato have been determined to be somewhat inferior to the protein from grains. Note carefully, however, that no practical application should be made of this statement or of similar discoveries that may yet be made indicating that the protein from this or that fruit or vegetable is not of high quality. The value of protein from fruits and vegetables is relatively unimportant, for these foods are not to be judged by their protein contribution to nutrition.

On the whole the question of protein has received more prominence in dietetic teachings than it really deserves, for while essential to life and growth it is sufficiently supplied in all mixed diets. The practical problem, both from a standpoint of health and economy, is to keep the protein content of the diet from being excessive. The dangers of deficiency in diet is not in protein at all, except in most unusual cases, but is the lack of mineral salts and vitamins, which will be discussed later.

Substitutes for Meat.—If the use of meats in the quantities ordinarily eaten in American homes is a dietetic evil rather than a benefit, what we want are not meat substitutes to give us an excess of protein, but merely other normal foods to replace the meat eaten.

Because of the reasons given there is little need for the use of high protein meat substitutes. The vegetable proteins are not as palatable nor as well suited to our bodily needs as the proteins of animal origin. The use of proteins from milk and eggs will prove more healthful than an excessive use of such vegetable protein meat substitutes.

But there is another sort of meat substitute thoroughly sound in theory and often necessary in practice. Our habits of eating require that the meal have a sort of centerpiece or hub which is preceded by the soup and followed by the dessert. In ordinary American cookery the *"pièce de résistance"* or hub of the meal has been a meat dish. With it we have eaten bread and butter, potatoes or other vegetables. There is no real reason why a meal need be eaten in this

fashion, but man is not a creature of reason but a creature of habit. To make food economy practical to the largest number of people the efficient thing to do is to require the least necessary change from past habits. Therefore habit requires the use of dishes that may be served as the hub of the meal, as meat is usually served. These dishes may truly be called meat substitutes, as they enable one to follow the customary meal habits and leave the table feeling well fed. The exact chemical composition of such dishes is of less importance than is the flavor and manner of serving. If one cannot give up the liking for the taste of meat, use for such meat substitutes may be dishes made of part meat, or of well-flavored fried or baked products which may be served or eaten in the same manner as meat dishes. The general adoption of such dishes in the place of straight meat will result in considerable saving in the food bill.

Mineral Elements in Food.—The composition of the human body as given by the physiological chemists includes sixteen chemical elements. These are present approximately in the following percentages:

	PER CENT.		PER CENT.
Oxygen	65	Chlorin	.22
Carbon	18	Sodium	.15
Hydrogen	10	Magnesium	.05
Nitrogen	3	Iron	.004
Calcium	2	Iodin	Trace
Phosphorus	1	Fluorine	"
Potassium	.35	Silicon	"
Sulphur	.25	Copper	"

The first four elements variously combined form the common food substance known as carbohydrates, fats and protein. These are the organic or nonmineral elements. The remaining eleven elements are minerals or inorganic elements. When food materials are burned these minerals are left in the ash, though in the ash they do not exist as the same chemical combinations as they do when combined with the organic material in food or in the body.

The older school of food chemistry left all these inorganic elements, or "ash" from the burning of food samples grouped together in the tables of food composition as "mineral salts" or "ash." Such method of food analysis was very incomplete and uncertain and, as recent scientific progress has shown, such lumping together of chemical elements vitally important in nutrition failed to tell us the whole neces-

sary truth. In a vague way the chemists realized that the ash content of food was of great importance and in some particular instances the specific purpose and use of these elements was known to the chemists. The followers of the natural school of dietetics, deriving their knowledge from practical observation of the effects of various diets, emphasized the supreme importance of the mineral elements in foods.

If any of the essential minerals are permanently absent from our foods, life could not go on. It follows that if any of these minerals existed in an insufficient quantity for a great enough length of time impairment of health would result. In some cases the deficiency of definite minerals gives rise to well recognized disorders. Thus a lack of iodine is held to be responsible for goiter, while lack of iron leads to a decrease in the red coloring matter of the blood, which condition we call anemia.

Without sufficient calcium and phosphorus the growth of bones and teeth cannot occur, as these two minerals, in combination, form the calcium phosphate of which teeth and bones are composed. The other minerals are also essential, but their functions are so generally spread through all tissues and organs that it is harder to name specific effects which are caused by their absence.

Mineral deficiency is a common fault of the modern diets. It so happens that the refined foods that have been produced by modern industry are the foods which are markedly lacking in minerals. Pure fat and pure starch or sugar contain no minerals at all. In refined cereals and especially white flour the amount of mineral elements retained is only about one-fifth of the original minerals in the whole grain.

Since man's instincts were created or evolved to function with natural foods many troubles result from our artificial and unbalanced food products. A varied selection of natural foods contain enough of these minerals, and hence general appetite calling for such foods would result in the supply being replenished. But with deficient foods we can readily see how this hunger of the system for some missing element might result in a continued overeating of the very deficient foods that are responsible for the condition.

A diet of refined foods such as white flour, polished rice, sugar, fats and meat may contain correct proportions of carbohydrates, fats and proteins, yet fail to properly nourish the body. On the other hand the natural foods such as milk, eggs, fruits, nuts, entire grain products, and particularly the leafy or salad vegetables, are observed

to be highly beneficial in normal diet and particularly useful in the diet of children, and as corrective elements for those suffering from ill health due to the deficiencies of the more artificial and conventional diet.

Of recent years not only has the testimony of the benefit of such foods which are rich in the mineral elements been repeatedly demonstrated in practice but the laboratory investigations of the physiological and biological chemist have produced an interesting and conclusive

A magnifying glass is here employed to make clearer the distinction between whole, unpolished rice and the polished rice ordinarily sold. The whole rice grains are browner in color, longer, and duller on the surface. Both the bran and the germ of rice are removed by the polishing process.

fund of knowledge which explains why such benefits have been attained. This knowledge not only teaches us the importance of the mineral content of food considered as a whole, but points out the particular physiological harm that may result from such deficiencies.

Much of the past argument regarding food minerals has centered about the question of their availability to the human body in inorganic form. Because these mineral elements are found in nature or may be manufactured in the laboratory without the aid of the life processes of plants and animals, there was a general belief among the old school of medical scientists, that mineral elements might be supplied to the body in the form of inorganic or artificial salts. On the other hand, the dietitians belonging to the natural food school held that while the chemical elements of food minerals could exist in inorganic combinations, they were not available to the use of the human body. Neither of these early views was entirely correct.

There are some mineral elements, as the sodium and chlorine of common salt, that can be utilized by the body in the simpler inorganic forms. But the more rare and hence more vitally important elements exist for the most part in complex combination with the organic elements of food, hence deficiencies in such elements cannot be made good by purely mineral or artificial products.

Of the mineral elements in the human body copper, iodine, fluorine, silicon, exists in such small quantities that they can be chemically detected by qualitative analysis only, hence any detailed study of their functions is impractical. However, as these elements often exist more abundantly in many plant tissues than in the human body it is not likely, with a varied diet supplying the other minerals, that any of these will be deficient, hence we need not consider them further in the present discussion.

Among the elements to be given further consideration, two, sodium and chlorine, are the components of common salt and are available to the body in that simple form. With conventional man's present custom of liberally salting his food there is no danger of these elements being deficient. In fact, salt requires consideration because of the possible ill effects that may come from the overeating of this common mineral.

The carnivorous animal secures an ample quantity of salt from his diet, for flesh, and particularly blood, is distinctly salty. Many herbivorous animals, both in a wild and domestic state, crave salt. As this is practically the only case in nature in which animals seek food

in a mineral form, scientists have searched to find some logical explanation of the phenomena. One view holds that sodium chloride (salt) is craved by animals existing on a vegetable diet because of the overabundance of potassium or potash salts in vegetable substances. That potash is a highly important element in the composition of plants will be recognized by those who recall its great importance to the fertilizer industry and the rôle played in the World War by the isolation of the German potash mines. Potatoes are particularly rich in potash, and if the chemists be correct that may be a reason why we crave salt upon potatoes.

Unfortunately our modern methods of life have so changed our diet from the normal that few people know what a natural diet is, and the result is they do not get in their food a sufficient supply of these natural salts to build up the body to the most perfect vigor. Cooking also removes much of the organized salts, and to complete the cooking processes satisfactorily and make the food taste as it should mineral salt must be added. Where foods are boiled and the natural salts are leached out into the water and then poured away, as is so often the case, the foods do not contain the salts they should, and the body craves those elements in the foods of which cooking has robbed them.

Hence, in the majority of cases, there is an unsatisfied feeling if salt is absent, which most people proceed to satisfy by a too liberal use of an *artificial substitute* for that of which Nature originally gave an abundant supply. This seems to me to be the most rational explanation of the universal desire for mineral salt.

Common salt is unquestionably of supreme importance in the physiological processes. The adult human body normally contains about 100 grams, or one-fourth pound. The presence of salt in the body fluids is essential to the solution of protein. The relation of salt to the solution of protein may be clearly demonstrated with an experiment which anyone can perform in the kitchen. Take a small quantity of the white of egg. Place it in a tumbler of water and the albumen will be precipitated showing a milky whiteness. If salt now be slowly added to the water, the albumen will presently be dissolved and the liquid become quite clear. Different concentrations of various salts effect the solubility of many proteins according to the strength of the salt solutions. The normal workings of the body process unquestionably depend upon the proper content not only of sodium chloride but of other mineral salts in the fluids of the body.

Should a diet entirely lacking in organic or inorganic salt be fed to any person, death would be inevitable. But the essentiality of common salt in the diet does not justify its excessive use. When an excess is taken it is quickly excreted, but if the excess be too great it will result in the overstimulation of the digestive secretions and the interference of food assimilation. Excessive salt is also thought to have an unfavorable effect on protein metabolism. In the case of a long fast the salt excreted for the first ten days of fasting was fourteen grams, for the second ten days two grams, for the third ten days one-half gram. Thus between ten and twenty per cent. of the salt content of the body is rapidly excreted when we cease to take it in the food, while the remainder is husbanded very carefully. This would seem to indicate that we use too much salt.

Salt in connection with flesh gives rise to scurvy, salt-rheum, kidney trouble and other cutaneous and constitutional disorders. Salt is the cause of inflammation under the breasts, in the armpits and under the nose.

Those who habitually live as near to the natural diet as possible experience great discomfort from thirst if what would be regarded as an ordinary supply of salt meat or salt fish is given them at a meal. It should need no argument to prove that the excessive thirst produced is Nature's protest against a too liberal use of salty food.

Salt, in liberal quantities, as used frequently, is as directly blinding to the sense of taste as the direct rays of the sun shining in the eyes are blinding to the sense of sight. After a continued liberal use of salt the sense of taste becomes so blunted to the natural and finer flavors of food that nothing "tastes good" unless salted to the requirements of the eater.

Hence we should use a reasonable caution in adding salt to food. Do not allow the taste buds to become so blunted that foods are not satisfactory to you unless heavily salted. Use enough to satisfy the demands of a reasonably normal appetite and there will then be little danger of your being injured by its overuse.

Potassium.—The potassium salts are chemically similar to those of sodium, the most abundant form being potassium chloride. This we do not need to add to the food for the reason that it is abundant in all natural diets and therefore there is no danger of potassium deficiency where other mineral essentials of the food are provided for.

Sulphur.—Sulphur is distinct from the elements just considered, in that food sulphur is taken wholly in an organic combination. Min-

eral sulphur has no place in the diet and when administered as a drug passes through the alimentary canal as an entirely foreign substance. Sulphur, while a mineral, exists in food in combination with the nitrogen of protein, and in that sense may be considered as part of the organic foods. The amount of sulphur varies slightly with the different forms of protein, but on the average proteins contain about one per cent. of sulphur. The sulphur while taken into the body and utilized in organic compounds is reduced in the process of metabolism to inorganic forms and is eliminated chiefly through the kidneys as mineral sulphates.

As proof that the sulphur in the body exists as a constituent of protein, and not in the simpler forms, we note that in the case of fasting, sulphur is excreted from the body at a rate proportionate to the excretion of nitrogen, both resulting from the destruction of the protein compounds. In the process of this destruction sulphuric acid is developed and must be neutralized into sulphur salts or sulphates. This aspect of the metabolism of sulphur will be considered again under the question of the acidity and alkalinity of the fluids of the body. As a practical dietetic consideration, sulphur need not be considered separately from the question of the protein because it will vary in direct proportion and if the protein needs are taken care of, the needs for sulphur will be automatically regulated.

Sulphur also appears in the decomposition of proteins in the intestinal tract giving rise to organic sulphates and to hydrogen sulphide.

Phosphorus.—The utilization of phosphorus in the physiological processes is highly complex. It enters into the composition of the cell nucleus and all cellular structure. Combined with calcium, it forms the chief mineral substance of the bones. It is a highly important element of milk. It exists in the sexual secretions and in the nerves and brain. From the early discovery of the presence of phosphorus in the brain came the saying of the scientists, "No phosphorus, no thought"; and from this same discovery came also the erroneous impression that fish was a brain food.

Functionally, phosphorus is involved in the process of cell multiplication, in the action of digestive and other enzymes, in the neutrality of the blood and body fluids, in the conduct of nerve stimulae, in the maintenance of osmotic pressure, surface tension and the circulation of body fluids, with the multiplication of cells and with the processes of absorption and secretion.

In fasting, phosphorus is secreted at a steady rate showing that it

is part of the living tissue being metabolized and not merely an excess of salt, as is the sodium chloride. The rate of phosphorus secretion in fasting also reveals the fact that bone tissue is being actually metabolized. The distribution of phosphorus in the body is that of 600 parts in the skeleton, fifty-six in the muscles and five in the brain and nerves. The rate of phosphorus secretion in fasting is such that all the phosphorus excreted could not possibly be derived elsewhere than from the phosphorus in the bones. Hence in fasting, or when phosphorus is absent from the diet, the store in the bones is drawn upon for other physiological needs, in which service the phosphorus is rendered valueless for further body use, hence it is excreted.

It has been shown that milk cows and nursing mothers, on diets deficient in phosphorus, draw upon the supply in the bones, with a resulting weakness of the skeleton. Pigs at the Kansas Experiment Station were fed a diet deficient in mineral ash, and their bones were found to be only half as strong as those in normally developed swine.

In the complete diet this element exists in three organic forms, besides the mineral form of phosphorus. The first of these is the phosphorus-containing proteins, notably milk, casein, and ovovitellin of egg yolk. Phosphorus proteins exist in the nuclei of all cells, hence in the proteins of all flesh foods.

The second kind of organic phosphorus is that of phosphorized fats, chief of which is lecithin, a highly important substance found abundantly in the brain and in the yolk of eggs.

Phosphorus also exists in food in combination with carbohydrates. A very surprising recent chemical discovery is that phosphorus in a very small quantity is an essential element in starch.

Experimentation leads us to the belief that phosphorus for bone growth can be absorbed from the simpler mineral forms, but for other bodily uses the phosphorus must be derived from the more highly organized forms. As evidence of this we find that the mineral phosphorus in the milk of different species is in proportion to the rate of growth of the young, and therefore cow's milk is richer in pure phosphorus than human milk, but there is as much phosphorus combined with fat in the form of lecithin in the human milk as there is in the milk of the cow. This may be one of the reasons why cow's milk, when modified, is still not as perfect a food for the human infant as the mother's milk.

A number of experiments have been conducted in an effort to solve this problem of the comparative dietetic worth of food phosphorus in

organic and inorganic forms The results are somewhat contradictory and the scientists are not fully agreed in the matter. Much of the experimental evidence indicates the distinct superiority of the organic forms of food phosphorus, while in no case does the pure mineral salt show any advantage The safe course, therefore, is to secure a high phosphorus content in its organic combinations in natural foods.

Efforts to exploit mineral salts as dietetic accessories are frequent not only in human medicine but in the nutrition of domestic animals. Years ago a grit for chickens composed of rock phosphates was very much advertised. Careful tests by experiment stations proved that such

Photograph Bureau of Home Economics U S Department of Agriculture

SOURCES OF PHOSPHORUS

Milk, eggs and cheese, as well as beef, poultry, fish and shell-fish are excellent sources of phosphorus although deficient in calcium Foods in common use deficient in phosphorus are sugar, starches and certain fats.

phosphorus rock was of no more value to the chickens than any other form of gritty substance, which the chicken uses for grinding food in the gizzard, and that the rock phosphate would not supply the food phosphorus which the poultryman usually secures from ground bones.

Like sulphur, phosphorus is broken down in the vital processes and is excreted from the body in the form of simple mineral phosphates. The amount of phosphorus needed in human nutrition is at least a gram per day. A study of many diets reveals that the phosphorus

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SOURCES OF PHOSPHORUS

Whole wheat and undenatured grain products contain phosphorus. The phosphorus content of grain is chiefly determined by the method of milling. Other sources of vegetable phosphorus are peas, lentils and beans, cauliflower, string beans and spinach, potatoes and nuts.

content is likely to be below this minimum need particularly when the diet is composed largely of white flour, polished rice, sugar and other demineralized foods. The safest correctives of the phosphorus-lacking diet is milk and eggs.

The following table gives the amount of phosphorus, calcium and iron in selected foods that are particularly rich or particularly deficient in these three most essential minerals. The amounts are not given per pound of the food but for 2,500 calories, which is the food requirement of the average active man for a day. This means that if a man lived wholly on lean beef he would secure five times as much phosphorus as needed, but would secure but one-third the necessary calcium. While if he lived on oranges, he would secure but one-tenth

QUANTITY OF ESSENTIAL MINERALS SUPPLIED BY 2500 CALORIES OF VARIOUS FOODS

	GRAMS OF PHOSPHORUS	GRAMS OF CALCIUM	MILLIGRAMS OF IRON
Spinach	5.40	6.54	375
Lettuce	4.72	4.38	156
Lean beef	4.21	.15	81
Cheese	4.02	5.40	9
Beans	3.61	1.17	49
Milk	3.34	4.35	8
Eggs	3.58	1.35	47
Turnips	3.12	3.97	32
Whole wheat	3.34	.33	35
Carrots	2.51	2.80	42
Oatmeal	2.38	.41	21
Cabbage	2.34	3.55	86
Beets	2.13	1.60	32
Peanuts	1.93	.33	9
Almonds	1.78	.89	15
Potatoes	1.71	.43	35
Walnuts	1.34	.33	7
Oranges	1.06	2.17	10
Prunes	.83	.43	25
Bananas	.71	.22	15
Polished rice	.68	.03	5
White flour	.61	.15	12
Apples	.55	.30	8

the phosphorus needed but four times more calcium than the body requires, etc.

Calcium and Magnesium.—Calcium and magnesium are chemical elements of somewhat similar properties. Both occur combined with phosphorus in the bones. Egg shells are composed of calcium carbonate, and the similarity to magnesium is revealed by the fact that hens fed a diet deficient in calcium but rich in magnesium will lay eggs with the shells composed of magnesium carbonate. But in more complex physiological needs, even these related elements cannot be so readily substituted for each other.

The calcium salts in the blood are intimately related to its power of coagulation. The balance between calcium salts on the one hand and those of sodium potassium on the other is thought to be the chemical basis of the control of the heart beat. The calcium salts seem to stimulate the contraction of the muscles, and an excess of calcium causes what is known as calcium rigor of the heart. This statement will show the high importance of the mineral salts in sustaining and regulating the life processes and the actual dangers of possible deficiencies—for while the body may find ways to rid itself of an over-supply, if the elements are not present in the diet it cannot be created in the body if there is an undersupply.

As a practical dietetic problem magnesium needs no separate consideration because the quantity required is relatively small and because it is usually associated with calcium in such quantities that if the calcium supply be sufficient the needs for magnesium will be taken care of.

The total weight of calcium in the body is the greatest of any mineral, and, like phosphorus, it is unevenly distributed, being by far the most abundant in the bones. Calcium is also quite irregularly distributed in foods, and hence an ill selected diet creates a danger of a calcium shortage. A study of the usual diets of various groups of people indicates that calcium is the food element most frequently deficient. Many of the cases of malnutrition, especially among children, that were formerly considered to be due to a lack in protein are now known to be caused by a lack of calcium. As in the case of phosphorus, milk so rich in these two elements essential to bone growth, is the article to be first replied upon in guaranteeing against calcium deficiency.

Meat, when free from bones, is not sufficiently rich in calcium to nourish the young of carnivorous animals. The failure of lions to

bring forth healthy young in captivity has been found to be due to the habit of feeding them upon meat from which the bones have been removed Puppies fed pure meat and fat have suffered a check in their growth which has been remedied by giving them bones to gnaw Pigeons fed food deficient in calcium give an outward appearance of maintaining health, but upon being killed and examined it was found that the bones had suffered degeneration even to the extent of the perforation of the skull.

Earlier scientific investigators failed to realize the full extent of the calcium needs of the body, due to the fact that they assumed that all of the calcium was excreted by way of the kidneys and that the calcium in the feces was an indication that much calcium in the food was not digested. It has now been discovered that the calcium in the food is absorbed and again excreted by way of the intestines, hence the erroneous reasoning which led to underestimating the calcium needs. The body requires at least one-half gram of calcium per day, and a larger

Photograph Bureau of Home Economics, U S Department of Agriculture

FOODS SUPPLYING CALCIUM

This mineral is found in buttermilk as well as in whole milk. Some of the best calcium-containing foods are here shown. Among these are oranges, cabbage, cauliflower, spinach, figs, turnips, carrots and parsnips, as well as celery. All forms of cheese are excellent sources of calcium.

amount is a safe estimate because there is greater danger from deficiency and little danger from a moderate excess.

Growing boys from six to ten years of age were found to accumulate calcium in the body from the rate of four-tenths grams per day, which does not account for that required in the various physiological processes and again excreted. An ample calcium supply is highly essential to the pregnant and nursing mother, for if either phosphorus or calcium be lacking in the diet the supply in the bones will be drawn upon to meet the demands of milk secretions.

Iron.—Of all those chemical elements which exist in the body in measurable quantity iron is the rarest. The total quantity in the human body is hardly more than one-tenth of an ounce, or but one part in 25,000 of the weight of the body. But small as is this quantity, it is absolutely necessary to life. Iron in highly organic combination is essential to the composition of the hemoglobin of the red blood corpuscles, the substance which gives them their peculiar power to carry oxygen from the lungs to the tissues. Lack of iron produces anemia, a very prevalent disease symptom due to the decrease in the red corpuscles.

This function of iron has been known to the medical world for many years, and mineral iron in inorganic form was the classic prescription for the cure of anemia. The modern biological chemists have attempted to investigate this problem with a view of determining whether such mineral iron was effective or whether its use was merely a fallacy reasoned from the chemical knowledge of the presence of iron in the blood corpuscles. As in the case of the phosphorus problem, much argument has been waged as to the conclusion to be drawn from this experimentation. Formerly favorable results have been reported from the use of medicinal iron, but the results were not conclusive. The modern view seems to be that the mineral iron is not available for this highly important physiological function, and that such favorable results as have been reported from its use were either due to other causes or that the normal usefulness of mineral iron was merely to spare in some way the destruction of the true food iron. For instance, iron combines with hydrogen sulphide in the intestines, and perhaps the presence of mineral iron may in this manner prevent undue destruction of the true food iron.

The best scientific opinion today concedes that with iron, as with other highly complex mineral food substances, it is a dangerous expedient to attempt to rely on the artificial products of the chemist, as

substitutes for the natural organic combination of minerals with food substances evolved in plant life, from which source the human and the animal body under natural conditions secured mineral elements.

Food iron is absorbed from the small intestines and deposited in the pancreas, liver and marrow of the bones, where the red blood corpuscles are formed. The minimum body requirement of iron is about ten milligrams a day, which in a normal diet furnishes iron in about the same proportion that it is present in milk. Compared with human needs, iron is more rare in milk than are other essential food minerals. The probable explanation is that the iron of milk exists in a chemical form highly adapted for physiological use without waste, whereas iron in other food substances may be only partly available to the physiological needs. The shortage of iron in milk is explained by some scientists by the reputed presence of a store of iron in the body of the child at birth. It is stated that the young of such animals as have short nursing periods show no such store of organic iron. While this theory does not seem altogether plausible, the fact is clearly established that the iron content of milk is no more than a safe minimum, and that may also have a practical bearing on the poor nutritive value of a diet for the human infant that consists in diluted cow's milk or diet of milk supplemented only with cereal substance and sugar. The use of fruit and vegetable juices to supplement such artificial feeding of children is found in practice to prove a safeguard against malnutrition, which fact may be related to this problem of the supply of organic iron.

The iron content of meat is chiefly in the blood contained in the meat tissues. Moreover, it is doubtful if this eating of the spent blood corpuscles of other animals gives a suitable supply of iron for forming new blood corpuscles.

Wheat is robbed of its iron supply in the milling of white flour, which contains only one-sixth as much iron as whole wheat. In a carefully conducted experiment two groups of young rats were fed white bread and bran bread. The rats fed bran bread gained about four times as much in weight as the white bread rats. They were killed and an estimate made of the red corpuscles. Only two-thirds as many of these oxygen-bearing messengers were found in the white bread rats as were found in their bran bread brothers.

Mineral Nutrition and Acidosis.—One hears much these days of acidosis. This is not a disease but it is a condition in the body that may be a contributing cause to many diseases.

There are several forms of acidosis, or cases of excess acid in the body. Those who are familiar with the discussion of diabetes will often hear the term used in reference to a very serious condition that can develop in that disease. That, however, is a very exceptional form of acidosis. It is due to the formation of an acid substance called acetone which is derived from an incomplete combustion of fats. This is likely to occur in diabetes because they are put on a high fat diet to avoid carbohydrate food. The fat oxidizing capacity is thus over-taxed and fails to function properly.

Another bodily condition that is erroneously confused with acidosis is hyperacidity of the stomach. One specific kind of acid is responsible for that condition and it is the hydrochloric acid that is a normal part of the gastric juice and plays a normal part in digestion. The condition known as acid stomach or hyperchlorhydria is merely due to an excessive secretion of the normal kind of hydrochloric acid. The source of this acid is sodium chloride or common salt, which is a neutral substance and is neither acid nor alkaline. The cells of the stomach wall are able to separate the salt into its acid or chlorine element and its sodium or alkaline element. The acid element is poured out into the stomch and the alkaline element is held in the blood and later is secreted in the intestine. Having performed their separate functions these elements are again united to form neutral salt. Hence the local acid and alkaline condition in the digestive tract is something that is independent of the general acid-alkaline balance of the body as a whole, and has little to do with the general question of mineral nutrition. It is, of course, true that one may eat too much common salt, and that to do this is undoubtedly harmful. The body's natural call for salt can become depraved and salt may be used in great excess. Some salt we must have, but natural foods contain it without any artificial additions at all. That they do not contain enough is argued from the fact that many animals seem to crave additional salt. Still since it is almost impossible to live in a civilized land and wholly avoid salted foods I do not think there is the least danger of any shortage of common salt. Whatever danger there is lies in the possibility of an excessive use.

Acidosis properly defined is an abnormal condition of the body due to a reduction of the normal alkalinity of the blood and body fluids. It results, among other things, in a strongly acid urine and a failure to absorb uric acid. This problem of the balance of acids and alkalies in the human body is a very complex one, the full theoretical discussion

of which cannot be given here. The condition of acidosis may be temporarily and artificially corrected by the administration of sodium bicarbonate.

But this, like many medical measures, is in no sense a true and permanent remedy. But this form of soda may be used, however, in diagnosis of this abnormal condition. The urine is normally slightly acid, but a dose of from five to ten grams of soda will result in causing it to give an alkaline reaction to litmus paper. But if the blood be abnormally acid, this amount of soda will fail to turn the litmus paper blue and a condition is indicated which can only be permanently remedied by a correctly balanced diet.

Many chemical substances contribute to the total contents of acid and alkaline elements of the blood. The absorbed carbon dioxide is slightly acid, while the majority of the mineral salts in the blood are alkaline. The true balance gives a mildly alkaline reaction, but the normal blood condition is so near the marginal line of neutrality that the failure of the alkaline yielding salts or an increase of foods that form acids in their metabolism will result in an increase of the acid elements. When body proteins are finally destroyed in the various vital processes, the sulphur content in them is oxidized to the highly powerful sulphuric acid. If this acid remained unneutralized it would prove exceedingly poisonous and destructive to cellular life. In practice sulphuric acid never exists in the body as such in any measurable quantity, but it is constantly being formed and as quickly being neutralized by the alkaline minerals.

Alkaline minerals are needed for the neutralization of this sulphuric acid. But these alkaline salts in neutralizing the acid lose their alkalinity, hence the danger of acidosis when there is too much acid to be taken care of. As a chief source of the acid is from protein, particularly meat proteins—neither meats, fats, sugars, nor starches, bear alkaline salts—the natural correctives are the vegetables, rich in the alkaline salts.

Acidosis is in common experience caused by a lack of the alkaline minerals. These are sodium, potassium, calcium and magnesium. The chief acid minerals are phosphorus, chlorine and sulphur. The balance of these two sets of minerals in the body is exceedingly important.

In the normal diet of man the alkaline minerals are in excess, and they must be kept so if we are to maintain normal health. In addition to eating enough alkaline minerals to counteract the acid minerals we

must also have enough reserve of alkaline minerals to neutralize certain acids that are produced in the body itself. Flesh, whether of man or animals, contains an excess of acid minerals, yet the blood is slightly alkaline, and it is very important that this condition be maintained.

Meat in the diet is the greatest source of an excess of acid minerals. The second source is cereal foods—that is, any form of food made from grains Since the conventional diet of civilized man is a meat and bread diet, we see why acidosis is so common

No matter what the source of acid in the body is it must be counteracted by alkaline salts, and these in available form can best be secured

Photograph Ewing Galloway

The vegetables here shown are of value in the alkaline diet. They include carrots, parsnips, cabbage, spinach, string beans, tomatoes, turnips and onions.

from vegetable foods. The following table gives the units of excess of acid or alkaline elements in various common foods.

ACID FORMING FOODS

	UNITS		UNITS
Fat-free meat or fish	12.	Whole wheat	3.3
Lean meats (including poultry)	10.	Oatmeal	3.
Fish (average)	10.	Rice, white	2.7
Liver	7.9	White flour	2.7
Egg white	9.5	Lentils	1.5
Green corn	1.8	Cornmeal	1.2
Egg whole	7.5	Walnuts	1.1
Egg yolk	7.	Peanuts	.7

ALKALINE FORMING FOODS

	UNITS		UNITS
Spinach	113.	Cherries	8.
Cucumbers	45.	Prunes	8.
Celery	42.	Raisins	7.
Chard	41.	Plums	7.
Lettuce	39.	Turnips	7.
Figs	32.	Strawberries	6.
Tomatoes	25.	Bananas	6.
Carrots	24.	Pears	6.
Beets	23.	Apples	6.
Olives	19.	Squash	6.
Cantaloupe	19.	Pumpkin	6.
Cabbage	18.	Buttermilk	6.
Parsnips	18.	Skimmed milk	5.
Cauliflower	17.	Navy beans	5.
Pineapple	16.	Sweet potatoes	5.
Lemons	14.	Cranberries	3.7
Oranges	14.	Asparagus	3.6
Grapefruit	14.	Chestnuts	3.2
Raspberries	13.	Dates	3.2
String beans	13.	Onions	3.1
Lima beans	12.	Grapes	2.8
Peaches	12.	Milk	2.7
Apricots	11.	Kidney beans	2.7
Radishes	10.	Currants	1.8
Watermelon	9.	Peas	1.5
Potatoes	9.	Cocoa	1.
Mushrooms	9.		

NEUTRAL FOODS

Lard	Butter	Sugar	Honey

It should be understood that the problem is not one of balancing acids with alkalies, but of taking a liberal excess of alkaline foods. In the first place the blood must be maintained in a positive alkaline condition. The phrase "acid blood" actually is a misnomer, since positively acid blood is not compatible with life. The condition that really exists is that there are always both acid and alkaline elements in the blood. But the positive balance must be maintained on the alkaline side. When the proportion of acids increases, either from the increase of acids or the decrease of alkalies, a dangerous condition exists, and we speak of the blood as becoming too acid, even though it may never reach a stage where acids actually predominate.

It would appear from the diet list that it should be very easy to maintain an alkaline blood. This would be true if the only sources of acids were the foods eaten. But in addition to these we also must neutralize acids generated by the body itself. This process of acid production is always going on, but since the destruction of the body tissue during weight reduction is greater than at other times we then have an additional source of acid formation. This is why the use of strongly alkaline foods is especially important in a health building diet.

We have one further point to consider under this subject of acids. It is a very confusing point to many people, because the acids that are recognizable by the taste in foods are not commonly the mineral acid forming elements but are the organic acids, especially those in sour fruit and sour milk.

These organic acid foods are not acid forming foods. The acids which affect the acid-alkaline balance in the blood are mineral acids. The fruit and sour milk acids are not mineral acids at all but are organic acids made by the rearrangement of the atoms of the same elements that make starch and sugar. These acids are speedily burned or oxidized in the body just as are other fuels and are changed into carbon dioxide and water and speedily eliminated. This is not a matter of theory only but has been positively proved in experimental tests.

Men have been put on a diet of oranges in which they ate up to two dozen oranges a day, and yet their blood when tested during this period showed a steady increase in alkalinity. This was due to

the splendid alkaline minerals of the orange which are in combination with the citric acid, and which when the acid is burned up are then freed to serve as alkalies in the blood and neutralize the harmful acids and eliminate them through the urine. The lactic acid of sour milk acts in the same way.

After this explanation is given some people get the idea that all acid foods are changed to alkalies in the process of digestion and that the degree of acid taste in foods is a measure of alkaline effect. This is not true, as a consulting of the table will show you; you will find that leafy foods that do not taste acid at all are much richer sources of alkalies than the most acid tasting foods. Moreover, such a doctrine would be a dangerous one, because it would lead people to think that they would be benefited by adding acids, such as vinegar, to their food. The use of mineral acids in food or drink to give a sour taste might also be encouraged, and that is a highly dangerous procedure. Artificial beverages made of hydrochloric or sulphuric acid cannot be too highly condemned and are forbidden by law. Phosphoric acid, however, is legally permitted, on the grounds that phosphorus is an element of nutrition. But we get all the phosphorus we need from food and if the foods are badly selected we get an excess; the adding of more phosphorus in the form of drugs or beverages may be highly injurious.

The same thing is true of sulphur, and the process of sulphuring fruits to bleach or preserve them is decidedly injurious to health. The adding of benzoic acid to foods or beverages, especially cider because it is drunk in large quantities, is another reprehensible act which the government allows. Between cider which contains alcohol and cider which has been preserved by benzoic acid or its salts, that containing alcohol would be the less harmful.

Vitamins—The Biological Analysis of Food.—The term "vitamin" was originated by the scientist Casimir Funk, about 1912, while investigating the problem of beri-beri, the deficiency disease caused by a diet of polished rice or grains of similar food properties. Other investigators had learned that a similar disease could be caused by a polished rice diet fed to pigeons. They had also observed that the disease could be cured, as in man, by feeding whole rice or other natural food substances. Funk attempted to isolate and analyze the chemical constituents of the missing food essential in the rice germ, or bran. He was not successful in determining the chemical composition of this mysterious substance, but he learned many of its properties,

and that it existed in very minute quantities and was not a mineral salt. He termed the mysterious substance a "vitamin" and conceived the theory that vitamins were specific substances in food, the absence of which would cause specific diseases. The expectations of this investigator were that scurvy, pellagra, rickets and perhaps other diseases known to be caused by a deficient diet could be cured by the specific "vitamin" or missing food element, should it be discovered.

This theory that each food deficiency disease has its particular preventive vitamin has not been established by later investigations. But like many erroneous theories, the vitamin idea has proved of great importance in the stimulation of scientific research. Moreover, the publication of such scientific researches together with the use of the very suggestive term vitamin, turned the popular imagination toward the broad and general problem of the dangers of an artificial, denatured or deficient diet.

Animal Experimentation.—In this eager search for vitamins the scientists have adopted a method of research comparatively new to food problems. It is that of animal experimentation or biological testing of foods as distinct from the older method of chemical analysis. Animals, particularly small mammals that are easily kept in laboratories, such as guinea pigs, white rats and mice, had been extensively used by the bacteriologist in food experimentation as well as in testing the strength and effect of drugs, particularly those which could not be satisfactorily analyzed by chemical methods.

Let us review the facts regarding the unidentified food essentials popularly termed vitamins, and also the methods and results achieved by biological chemists who have investigated food problems by the method of animal experimentation. The general plan followed in such investigations is that of feeding a diet of foods the exact chemical properties of which were known, and to which may be added one or more foods the particular effects and properties of which the investigator wishes to discover.

There are differences of opinion between this school of food experimenters and the old school of chemists, who confined food investigations to purely chemical analysis. However, it should be noted that it was the achievements of chemical science which enabled such diets composed of selected pure food elements to be prepared, which has made possible the biological researches.

Reference has already been made, in the discussion of protein and mineral salts, to results obtained with animal experimentation. Many

of the earlier investigations in this field were with domestic animals and were conducted for the purpose of gaining information on animal nutrition. At the University of Wisconsin cows were fed diets derived wholly from the corn plant and compared with other cows fed wholly from wheat and from oats, in each case the food including not only grain but the fodder or straw. The cows were able to live on all three diets, though the corn-fed animals were the more thrifty. But particularly interesting were the results in the bearing of the young. The calves of corn-fed cows were healthy and normal, while the wheat-fed cows gave birth to their young prematurely, and the young were either born dead or died within a few hours. Oat-fed cows gave birth to weak calves, many of which died at an early date. The corn-fed cows produced nearly three times as much milk as the wheat-fed animals.

All this was exceedingly interesting and clearly demonstrated the insufficiency of the old food standards which were content to prescribe certain proportions of fats, carbohydrates and protein. The rations from the corn, wheat and oat plant had all answered the older chemical food standards. Here was a mystery that escaped the chemists. Here also was evidence that if food problems were to be solved, it was not sufficient to merely conduct experimentation for a few weeks or months with adult animals or even with the growing young, for the significant deficiencies were only revealed with the process of reproduction. The advantage of conducting such researches with an animal of brief generations, like the rat, is obvious. Moreover the rat is by nature omnivorous, hence the presumption that his dietetic needs are more nearly akin to man's than to those of a cow or dog.

It should be remarked at this point that the biological method of research has emphasized the fact that the fundamental chemical laws of nutrition apply pretty generally to all species, the chief differences between various species being in the mechanical or physical differences in the diet and the consequent adaptation of the digestive organs to various degrees of food bulkiness. Herbivorous animals have large digestive tracts for the digestion of bulky foods. Carnivorous animals occupy the other extreme, while omnivorous animals are intermediate. Some differences also exist as to the proportions of various food elements required, particularly as determined by the rate of growth of the young. But the essentiality of a particular element and the effects of its absence on the organism seems to apply generally to all warm-blooded species, and certainly to all mammals. Hence, while we can-

not look upon experiments with pigeons or rats as absolutely applicable to the human species, we must accept the view that fundamental laws can be discovered in this manner. Experimentation requiring feeding for a complete generation or for several generations when applied to humans would involve insurmountable difficulties.

Discoveries by McCollum.—The experiment in feeding cows, above referred to, led E. V. McCollum to undertake exhaustive experiments in systematic biological feeding tests that have resulted in materially furthering the world's knowledge of the science of nutrition. His first discovery that led to important results was that rats would not thrive on a diet of purified foodstuffs, though it included ample skim milk protein and mineral salts; but that normal health and growth could be secured if a small amount of butter were added to the diet. Since the rats were already getting ample fat from vegetable sources it was evident that it was not the added fat of the butter but some unknown substance existing in the butter in small amounts. The view that this newly discovered food essential was some material dissolved in fat was further proved by the fact that egg yolk was found to be efficient in the same way as the fat of butter; lard and vegetable oils failed utterly to support growth. It was thus proved that all fats were not of equal dietetic value, although the chemists had always reckoned them so.

The first impression was that this unknown food essential or vitamin was the same as that discovered by Funk in the germ and bran of rice. But the diet upon which the rats were first fed and which was completed by the addition of butter fat was later found to contain the water soluble vitamin as an impurity in the milk sugar, for when the sugar was more carefully refined it was then found necessary to add the water soluble vitamin also before the diet would sustain life and growth. A further series of careful experiments revealed that there were two food essentials or vitamins of unknown composition, one of which was soluble in water and one of which was soluble in fat. Rejecting the term "vitamin" McCollum named these essential elements "water soluble A" and "fat soluble B." A mixture of refined foods containing carbohydrates, proteins, ordinary fats and mineral salts will not support growth unless both of these vitamin food essentials are present.

The original vitamin theory that held that each deficiency disease was caused by the absence of a particular vitamin was thus disproven, as many diseases were found to be curable by diets containing, in

addition to ordinary fat, carbohydrates, suitable mixtures of protein, and salts, the water soluble vitamin, first discovered by Funk in rice polishings, and the fat soluble, first discovered by McCollum in butter fat.

Since a diet may be deficient in the quantity of protein, carbohydrates or fats, and since it also may be deficient in the quality of proteins or in the quality or quantity of any of several mineral salts, and lastly in the quantity of either of the two vitamins, we readily see that the deficiencies in one or more of these varied essentials may cause various symptoms and diseases of malnutrition. The complexity of the

Photo Ewing Galloway

Of all foods wheat is most abundantly used by English speaking people. The greatest bulk is used in the form of bread, but many cereal foods are prepared from the grain.

problem seems to permit of a sufficient explanation of the numerous manifestations of food deficiency that have been observed.

A further important discovery made by McCollum relates to the value of grain or seeds in nutrition. He found, with numerous experiments, that no single grain or combinations of grains was sufficient to sustain normal growth in young rats. Further search of natural habits of animals and the records of feeding tests revealed the fact that no warm-blooded animals in Nature or in the experimental laboratory derived complete nutrition from seeds alone. Even seed-eating birds add insects, green leaves and sprouts and minerals taken in the form of "grit," to their diet.

Artificially milled and refined grain product were found to be deficient in the water soluble vitamin, but this deficiency is remedied when the whole grain is utilized. Most whole grains contain some of the fat soluble vitamin, though not enough for complete nourishment. Whole grains are therefore a far better source of nutrition than the denatured milled product.

By investigations of the relative value of natural foods McCollum discovered that the addition of any sort of edible leaves to a diet of grains or meat, or grain and meat, greatly increased the growth sustaining power. A diet of 60 per cent. of any seed or grain with 40 per cent. of alfalfa leaf flour was found to be greatly superior to any possible diet that could be made solely of grains, legumes, or other seeds. When the diet was composed of 50 per cent. corn, 30 per cent. alfalfa leaves and 20 per cent. peas, the experimental rats were able to complete their growth and reproduce their kind for several generations. This diet for the rat was the best diet of wholly vegetable origin discovered by McCollum. While the rats lived and reproduced upon it, they did not reach a maximum efficiency of growth and vitality. Out of many hundreds of vegetarian diets tried, none was found that would nourish the rat as completely as a diet including some foods of animal origin, particularly those diets that included milk.

Essential "Protective Foods."—The same fact had been found to be true in the nutritive of pigs, which like rats are considered omnivorous in their habits. The statement applies equally to chickens and ducks. With all these domestic animals more profitable growth can be secured if some foods of animal origin are given, and with all of them the most efficient of all animal foods is milk. It is interesting to note that in all these species where animal foods are not available,

the addition of leafy foods is a great help toward perfect nutrition. The practical observations of animal feeders bear out McCollum's contention of the superior value of milk and green leaves as the essential "protective foods." The addition of milk to a diet of grains makes possible growth and reproduction in all these species, and the same principle undoubtedly applies to man. Where milk is not available the best substitute is leafy foods. Thus we can explain the nutrition of the people of India, China and Japan in whose diets milk has small place, for these people use ample quantities of green vegetables. In practical application the use of both milk and green vegetables is found in animal feeding to give superior results to the use of either alone and the same conclusion we may safely apply to mankind.

McCollum pointed out the fact that these highly important discoveries in food science were utterly ignored by the merely chemical consideration of foods as carbohydrates, proteins and fats, etc. He advises that practical dietetics be taught by grouping foods, in accordance with the purpose of the food in the economy of the plant or animal from which it is derived.

By this system milk unquestionably deserves a distinct place as a food of the highest order. Its function in nature is that of a food for the young mammal. No other food product used by man has such a complete natural function. The nearest approach is that of eggs, which are slightly inferior to milk for the following reasons: They contain no carbohydrates, as the chick growing within the shell needs little energy because it is inactive. Secondly, the edible portion of the egg is more deficient in calcium, as the chick obtains a portion of this element required for bone growth by dissolving the calcium carbonate from the egg shell. Lastly, the chick, not being a mammal, may on general principles be considered less closely akin in its nutritive needs to the human kind, that is the calf.

The second food group in McCollum's list is the leafy vegetables. Ample experimentation has proved leafy foods to contain the vitamins and minerals deficient in many commercial grain and meat products.

The third food group in this system is that of seeds or grains. The place of the seed in Nature is that of a storehouse of food energy, and this function explains why the seed is rich in carbohydrates, as in the case of grains, or in fats, as in the case of nuts and many other seeds. The seeds, therefore, can supply in economical form the energy requirements of man, but they must be supplemented by other foods rich in the lacking essentials. The bulk of the seed kernel is in the

endosperm, which is rich either in starch or in oil. This portion of the seed is merely a storehouse of energy and is not composed of living cells containing the vitally active protoplasm. But the bran and germ of seeds is composed of cells and is a living portion of the plant, hence the use of whole grains is advantageous in the same way as is the use of leafy foods. White flour, polished rice, degerminated corn meal, vegetable oil or extracted sugar are all derived from the plant's surplus store of food energy None of these foods, nor any combination of them, is sufficient to support growth and reproduction. The use of the whole grain or product which contains the whole of these concentrated energy foods is much less dangerous than denatured foods, but even the use of these whole grain foods is not sufficient for the maximum efficiency in growth and nutrition unless supplemented by other foods.

Milk, eggs and green vegetables used in the diet are the surest means of avoiding food deficiencies. With an ample use of these highly enriched and protective foods

Photo Ewing Galloway

Corn on the ear, in dried form, is here shown. Corn bread is an excellent and appetizing food. Most of the cornmeal now commonly sold in the market is degerminated as white flour.

even a diet of denatured starches, oils and sugars may become safe. The logical and economical plan to follow is to use the grain and seed products in their natural and entire state and to add also the milk and greens. With such a diet the danger of food deficiency is banished and the diet is made healthful.

We have yet to consider certain further groups. Most vegetables, other than leafy greens, are tubers, roots or the thickened leaf bases, as in the case of cabbages, onions, chard and celery. Like seeds, the use of the roots and tubers in nature is that of a storehouse of energy for the next plant generation. This class of vegetables occupies an intermediate place in dietary value between leaves and seeds. If the vegetable is used in its entirety as in the case of potatoes, when the skin is eaten also, the value is likely to be superior to the grains. But if the raw potato be peeled with a knife, or if the sugar alone be extracted from the beet, we see again the denaturing process of extracting the energy food and discarding the vital cellular elements. Vegetables may also be "denatured" by the custom of boiling them and discarding the water, for many of the valuable elements are thus dissolved and wasted.

Many so-called vegetables, such as melons and tomatoes, are in truth fruit. Fruits may be given a dietary rank just below that of leaves. They are notably rich in minerals and presumably in vitamins, though at this writing they have not been experimentally tested for these elements. The chief value are all derived from the plant's surplus store of food energy. None of these foods, nor any combination of them, is sufficient to support growth and reproduction.

The conclusions concerning diet derived from the discovery of vitamins and the use of small animals instead of chemical analysis to test foods did much to justify the use of natural foods and also to show the importance that food plays in the preservation of health or in the cause of disease. All this amounts to virtually a revolution not only in food science but in medical science. As the result of these discoveries by a handful of scientists about the time of the World War was that thousands of scientists and doctors in dozens of countries turned their attention to similar researches.

The original vitamins discovered in rice polish and in butter have been increased by a number of others. One of these vitamins was practically discovered over a century ago, yet its kinship to the vitamins was not recognized for some time. This substance is now known as vitamin C. Lack of it causes the disease known as scurvy.

Scurvy has been recognized since the Middle Ages as a disease that occurred at seat on long voyages. It also occurred in Polar expeditions, prisons, armies on dry rations and in many other instances where men were on limited diets lacking fresh foods. Scurvy also frequently occurred in artificially fed infants, especially when they were fed milk that had been heated to kill disease germs.

It had long been recognized that when ships whose crews were afflicted with scurvy came into ports where the men could get fresh food that the illness quickly disappeared. It was also found that bottled lime juice could be taken on such voyages and its use tended to prevent scurvy. The lime is a species of citrus fruit and all these fruits are now recognized as being especially valuable in preventing scurvy. That is the reason that babies are now given orange juice. Tomato juice, however, is found to be about as effective.

All fresh fruits and all fresh vegetables supply this vitamin, but to be most effective they should be eaten uncooked. Heat destroys or greatly impairs this vitamin. That is why heated or pasteurized or canned milk is deficient in the vitamin. Fresh raw milk contains the vitamin in goodly amounts when the cows are on fresh pasture. But cows fed dry feed that lacks the vitamin yield milk that also lacks it. This fact plus the general use of pasteurized or heated milk has led to the general use of orange juice in all infant feeding.

Although the heat of cooking tends to destroy the vitamin it is found that the destruction is less in acid foods. Thus canned tomatoes or tomato juice are still good sources of the vitamin—though not as good as the fresh raw product. Alkali, the opposite of acid, tends to destroy the vitamin. Thus the habit of using soda with tomatoes or in cooking leafy greens is to be condemned. But added lemon juice to greens in cooking would tend to preserve the vitamin.

Vitamin C is widely present in all fresh juicy raw food products but is entirely missing in dry products such as flour and cereals, nuts, dry beans, etc. This vitamin and its destruction by drying and by heat furnished the chief scientific argument for the use of uncooked foods. For those who live in locations where they cannot get such fresh food, canned tomatoes, or the canned acid fruit juices now on the market, offer the best substitute source.

The naming of vitamins by the letters of the alphabet has now been generally adopted. Thus far we have considered three. Vitamin A, first found in butter. Vitamin B, first found in rice polish, and vitamin C first found in citrus fruit. The fourth is vitamin D,

and the first known source of it, and still the chief source is cod liver oil.

Here again we meet with the story of a disease that has long been a plague. It is that of rickets, a disease of faulty bone growth of infants and young children. It was discovered by trial and error that cod liver oil would prevent or cure this disease. It was also discovered that sun bathing was an equally effective remedy for the same disease.

This fact that the oil from the liver of a fish and sunshine on the skin should have the same effect was a curious fact, and a fact that many scientists have worked to explain. The explanation is that by Nature's plan this vitamin for man and most animals is not directly derived from the food, but is formed in the skin from ergosterol, a fat-like substance. To activate this ergosterol or change it into the vitamin requires the action of certain light rays. They happen to be invisible rays in the short end of the spectrum. They are found abundantly in bright sunlight and are also found in the rays of certain forms of lamps, popularly known as sun lamps. Lights that will cause the human skin to tan will generate the vitamin. Yet the tan is not the vitamin, but rather a protective pigment to prevent sunburn from an excess of the rays.

The explanation of the vitamin in cod liver oil is that the vitamin is stored in the liver. The cod frequents Arctic waters with a long winter night. Its sources of food during this period would presumably be lacking in the vitamin, and hence the development of the process of storing great quantities of it in the liver oil. Other species of fish also have the vitamin in the liver oil. In some it is richer than in the codfish, though the cod yields the most abundant commercial supply of such oil. The vitamin is found in the livers of other animals, and also is found in egg yolks.

The sources named are the chief natural food sources of this vitamin and it should be noted that they are all foods of animal origin. Men and vegetarian animals are not supplied with this vitamin in their foods, because they are constituted to manufacture it in their own skins by exposure to sunlight. The civilized habits of living indoors and wearing clothing upsets Nature's plans. The present worldwide return to outdoor life, to less clothing and to sun-bathing and nudity is largely the result of the modern discoveries associated with this peculiar vitamin.

Marvelous cures of rickets and other diseases have been achieved by sun-bathing. Tuberculosis of the bone is such a disease. It pro-

duces horrible deformities, and marvelous recoveries from such crippling diseases are achieved now in the famous sun cures.

For those who cannot or will not practice sun-bathing other sources of this vitamin are now available. The bad taste of cod liver oil has stimulated much research for less objectionable substitutes. Some of these are now in the form of tasteless and concentrated vitamin extracts made from cod liver oil. But a still more remarkable discovery was that the same effect of creating the vitamin that occurs in the skin can also be produced in the laboratory. The same ergosterol, derived commercially from yeast, can be exposed to the ultraviolet waves and changed into the vitamin (the product being called viosterol). This gives a concentrated vitamin that can be added to ordinary foods such as bread or milk.

Another phase of this series of interesting developments is that of feeding this vitamin to cows and to hens and thus getting the milk or eggs with the richer content of the vitamin. There are thus many ways in which the modern mother can protect her baby from the crippling deformities of rickets.

Valuable as are these discoveries, the makeshift ways of getting the vitamin does not lessen the argument for getting it in the natural method through exposure to sunlight. Indeed many students of sunbathing believe that there are other favorable effects resulting from sun-bathing. Certainly the enthusiasm of adult sun-bathers, whose bone growth is complete and who are hence in no danger of rickets, would bear out this view.

The explanation probably is that the metabolism of calcium brought about by the vitamin is important throughout life and in many other ways than its more obvious effect of bone growth.

The fifth vitamin in the series is known as vitamin E. Like A and D it is also a vitamin associated with oily substance and the richest known source of it is in the oil of wheat-germ. It is found to a lesser extent in many natural foods such as green leaves and the seeds such as grains and nuts.

This is called the fertility vitamin, because its complete absence results in sterility or the inability to bear live offspring. Males lacking this vitamin cannot produce offspring. Females lacking the vitamin, when mated to fertile males, may conceive young but the embryos die in an early stage and no births occur.

The name "fertility vitamin" naturally leads to the misconception that the vitamin is a remedy for impotency or inability to perform the

sexual act. Such does not however seem to be the case, for sexual performance is an entirely different thing from sexual fertility. Other vitamins also have bearing on sexual powers and fertility. Vitamin E also probably has other values relating to the growth of the young after birth as well as to the life of the sperm cells and embryos before birth. The wheat-germ, which is rich in several vitamins, seems to be a very valuable food to stimulate child growth.

Vitamin G, when lacking, enters into the cause of the disease pellagra. The use of its title vitamin G brings up the question as to why there is no vitamin F. The explanation is that what was originally considered as vitamin B was later discovered to be two vitamins, having somewhat similar yet distinct effects. These were named vitamin F and vitamin G. But that eliminated the B vitamin from the list and after considerable argument among the scientists the term vitamin B was restored for the fraction of the compound vitamin that prevents beri-beri. The term vitamin G then was applied to the later-discovered vitamin preventing the disease pellagra.

These diseases beri-beri and pellagra, present interesting contrasts They are both diseases that prevail among poverty-stricken and poorly-fed people, whose chief food in both cases is denatured grains. One disease prevails in the Orient, and the diet that causes it is a diet of polished rice. The other disease prevails in Europe and America, and the diet that causes it is a diet of white flour or degerminated corn meal, plus sugar and lard.

It would thus seem that the polished and degerminated rice still has a little of one fraction of this dual vitamin and that the degerminated wheat or corn has a little more of the other fraction. Both diseases affect the nervous system, and indeed for practical purposes neither the vitamins nor the diseases they cause need to be distinguished. The richest sources of both vitamins are yeast and wheat germ, and either food will prevent either disease, though yeast is the best pellagra preventative.

Another disease which at this writing is just being proclaimed as a vitamin deficiency disease is anemia. And yet anemia has long been considered as a mineral deficiency disease, due to lack of iron. That lack of iron will cause anemia is easily proven since anemia is due to a deficiency in red blood corpuscles, and iron is an essential ingredient of the red coloring matter of the blood.

But while anemia can be caused by lack of iron, yet not all iron-bearing foods are equally effective in its cure. Liver, for instance, has

remarkable curative powers for anemia which can hardly be explained on its iron content alone. A later discovery was that copper in very small amounts was also necessary to the formation of red blood corpuscles. This still did not explain everything about it, because while the addition of copper seemed to help, yet even both of these minerals failed to give the maximum effects that could be obtained from liver and certain other foods.

This suggests that the vitamin also has something vital to do with the metabolism of the mineral elements, much as the sunlight vitamin D has to do with calcium nutrition.

An entirely erroneous conception of the vitamins is given when they are considered only in relation to the prevention or cure of certain diseases. Disease is merely the extreme or final result of the lack of the vitamin. The vitamins are all necessary, just as are the minerals to life and health. It is only when some one vitamin is particularly lacking, while others are supplied, that we get the particular and comparatively rare effects of these definite diseases. Thus such diseases only appear in clear-cut form on certain limited and peculiar diets.

What commonly happens with poor nutrition is that lesser degrees of many of these food deficiencies are all produced at the same time instead of a sharp and particular deficiency of one thing. A vast amount of the ordinary weakness and illness of mankind consists of various degrees and combinations of these various food deficiency effects. The actual symptoms will vary too much to give them the name of any particular disease, and different doctors will diagnose the trouble in different fashions, as the symptoms vary with the individuals. But denatured and deficient foods are just as responsible for these mixed and confused and much more common states of ill health as they are for the more distinct deficiency diseases products of some very distinct type of deficient diet.

Conversely a correct and adequate diet builds up a general high state of health and increases the ability to resist all disease, whether ascribed to food deficiencies or to other causes.

Vitamins in Fresh Foods.—Dr. W. Arbuthnot Lane, internationally known for his services on behalf of modern methods of health conservation, while stressing the importance of the vitamins in his writings, makes the following statement:

"Nevertheless, the ultimate constitution of the vitamins remains a mystery. We know that they exist in certain foodstuffs, and that they

have vital and specific functions to perform in human nutrition, but so far they have defeated the efforts of the chemist to create them synthetically in the laboratory. We are not yet in a position to answer that simple question (not infrequently raised by the skeptic): What is a vitamin?

"It might seem, then, that many of the arguments advanced to the public by health propagandists, exhorting it to obtain 'an adequate vitamin balance' in the dietary, are without secure foundation. Actually, this is not the case. There is sufficient scientific evidence to establish the principle that, without a full complement of vitamins in the dietary, good health is impossible. At the same time, owing to our lack of knowledge of the fundamental nature and composition of the vitamins, it would be rash to assert that the ways and means of obtaining adequate supplies of the vitamins—so long as we do obtain them, are unworthy of consideration. Already, there have been made available concentrated preparations of certain of the vitamins, and already it has been suggested that, by the addition of 'potted' or 'tabloid' vitamins, a satisfactory dietary can be elaborated.

"In this suggestion is conveyed a dangerous half-truth, as the work of Dr. Chalmers Watson, a British authority on diet and nutrition, demonstrates. For some years Doctor Watson has been experimenting with irradiated milk (*i.e.,* milk exposed to the ultra-violet rays artificially), in the treatment of rickets. His results showed that irradiated milk produced an immediate and strikingly beneficial effect in cases which had previously been treated by the usual dietetic means, including irradiated ergosterol, well known as a concentrated vitamin D preparation.

"In some of the experiments, skimmed milk containing very little fat was used and equally good results were obtained, a notable point in this connection being that, according to biochemical testing, the proportion of vitamin D in the milk was very much less than in the various commercial preparations. From this data Doctor Watson postulates the view that the remarkable curative influence of irradiated milk is not dependent upon any vitamin D factor as determined by present laboratory methods—or, in other words, that an artificial concentrate of vitamin D has by no means the same health-giving properties as a 'live' food such as milk which has been exposed to the ultra-violet rays.

"It is Doctor Watson's opinion that our failure to discover the nature of the vitamins arises from the fact that hitherto scientists have tackled

the problem from the biochemical rather than from the biophysical side. In Nature, vitamins are only found in the vegetable kingdom, and there seems no doubt that they are produced through the action of sunlight. It is the solar energy, acting on the cells of the plant, which initiates the chemical energy that is passed on to the animal kingdom in the form of vitamins when the vegetable is consumed. Further research is necessary on the physical side to determine the mechanism of transformation of the sun's energy into vitaminic energy in plant life, and the energy value of food in relation to what may be termed its sunlight properties. This is a relatively unexplored field of inquiry but unquestionably a promising one.

"To come to the main and practical issue of Doctor Watson's investigations, we may sum it up in saying that the surest and best source of the vitamins which are essential for health is to be found in 'live' foods. By these are signified fresh fruits and fresh vegetables, raw or so cooked as to retain their salts and other active principles, fresh nonpasteurized milk, fresh eggs and meat and whole-meal cereal products."

Food and Constipation.—Constipation has been called the mother of diseases. It could also be called a general ailment of civilization. It is variously stated that from 50 to 95 per cent. of the people in a modern civilized community suffer from constipation, the estimate depending on how severe the case must be before we definitely class it as constipation.

Constipation may be defined as a delay in the elimination of waste from the bowel. It is commonly recognized as an infrequency of such waste elimination, but the more proper consideration is the length of time the waste remains in the large bowel after ordinary digestion in the small intestine is completed. The length of time from the eating of a given meal till the residue of that meal is eliminated should be from eighteen to twenty-four hours. In practice it is more likely to be from thirty-six hours upward.

The hardness and dryness of the final passages, and hence of the pain or difficulty of such passage, are incidental to this delay. The degree of offensiveness to the body or the body poisoning effects of the waste is another phase of the same problem. But the gist of the whole matter is in the retention of the waste for too long a period, which gives opportunity for bacterial decomposition or putrefaction to take place. This factor is again affected by the nature of food eaten. Protein in general and meat in particular give rise to much greater offense

from the retention of the waste than do other forms of food. Milk gives the least offensive form of bowel waste of any animal or protein food.

The reason that constipation is so general among civilized people is that many factors of civilization contribute to cause it. Decreased muscular activity and the weakening of the abdominal muscles is one of these causes. Another is the inconvenience and reticence under civilized conditions which establishes the practice of delaying evacuation and thus causes constipation to become a habit.

But of far greater importance than any of the above causes is the change in the nature of food. The relative size of the large intestine in various species of animals depends on the relative proportion of indigestible material in their natural diet. In the grass-eating animals it is very large because grass is bulky and contains a large proportion of indigestible fiber. In carnivorous animals it is much smaller because meat is compact and more completely digestible. Even among animals of the same general type, herbivorous or carnivorous, there are considerable differences. Thus the intestine of a rabbit is much larger than that of a squirrel because a rabbit eats bulky leaves and bark and a squirrel eats compact fat-containing nut kernels.

The human intestine occupies an intermediate position in the scale, and this indicates a diet that is neither so bulky as that of the cow or rabbit nor so compact as that of the cat or squirrel. But civilized man has adopted a diet that would be more suited to a squirrel, and the result is that his diet is too completely digested and does not contain enough waste. Because of this the waste of several meals will accumulate before there is enough bulk to stimulate the action necessary to expulsion.

The reason that man eliminated the bulky and indigestible fiber from his diet is that he has a natural instinctive preference for the more concentrated and fiber-free foods.

It was necessary for him to have this instinct in the jungle in order to select his food at all. If he tried to live on leaves, bark and twigs like an elephant he could not consume or digest enough nourishment. Therefore he was always searching for nuts, fruits, starchy roots and tubers, birds' eggs and the like, for these were the most concentrated foods he could find. Even at that, he could not avoid getting a fairly large amount of fibrous material.

But with civilization, first by cultivated foods and later by mechanical processes of eliminating the fiber, man has exercised his instinct

to avoid too much indigestible fiber to such an extreme degree that it has proven a very serious menace to his health by causing almost universal constipation.

Many people get the wrong idea about foods in relation to constipation. They think that any food that when used alone will cause constipation is a factor in producing it in a mixed diet. This is not true. For instance, meat, milk and eggs are virtually completely digestible. A diet composed of them will naturally produce constipation—unless they are taken in quantities exceeding the digestive capacity. In the case of the milk diet, when more milk is taken than can be digested the effect is not harmful because the surplus milk produces a nonpoisonous residue.

The correct plan is not to avoid such foods because they are completely digestible, for the elements of nourishment they provide are needed and we want to digest them. The remedy is to take these other elements that are not completely digestible in sufficient quantity and with sufficient frequency and regularity to completely solve the constipation problem. In other words a meal of milk and bran is not more constipating than a meal of bran only, or a meal of bran and water. With the exception of a few foods that might cause impactions or have a paralyzing effect on the bowels, there is no such thing as a constipating food, but only the fact that certain foods fail to cause frequent enough bowel action.

The foods recommended for the cure are those that have the largest proportion of cellulose of indigestible fiber. Chief among these is wheat bran. The effect of bran is similar whether it be eaten as whole wheat, whole wheat bread or taken separately as bran.

If the diet contains a normal proportion of wheat and all of this is eaten in its entirety as perhaps a cereal food or bread, the activity of the bowels will usually be well regulated. But where one is forced to eat white bread products, the error can be remedied by the separate use of bran. In such cases the bran may be used as a cereal dish or incorporated into bread recipes. About three rounded tablespoonfuls a day will return to the diet the proportion of bran removed from the white bread ordinarily eaten.

While the chief reason for using bran is that of increasing the bowel activity by the presence of the indigestible cellulose, the conclusion should not be reached that bran is all waste. It is rich in salts, vitamins and protein and also contains some digestible carbohydrate, in addition to the indigestible cellulose. In its composition bran resembles

leafy foods which are also excellent for increasing the food bulk and intestinal activity.

The word "indigestible" has two meanings, the one as applied to the failure to digest foods that should be digested, the other is the failure to digest inert substances that add bulk to the diet, but are not affected by the digestive juices. Indigestion of fats or carbohydrates and particularly of proteins is harmful because when not digested such material decomposes and poisons the system. Cellulose, on the contrary, though it fails to digest, does not decompose, and its presence is a benefit as the increased bulk stimulates the peristaltic action of the bowels and so hastens the removal of all food residue or bodily waste excreted by way of the bowels, the retention of which is harmful.

A general misconception is prevalent as to the source of the material passed from the bowel. With the exception of cellulose, very little of the feces, in the case of a healthy organism, is actual undigested food, but is composed of the residue of digestive juices and of material excreted from the body by way of the bowel. Man naturally lived on vegetable foods containing considerable cellulose.

The conventional foods of civilization have been denatured by the removal of the cellular outer structures. This is harmful, both for chemical and mechanical reasons. A properly balanced diet of whole grains, vegetables, fruits, nuts, milk and eggs would never cause constipation, although when the condition has become chronic some special cases will require more than a normal diet to effect a cure. On the other hand, after the system has, in a measure, become accustomed to functioning on a diet deficient in cellulose, the use of the quantity Nature intended may, in some cases, bring about too rapid movement of the food through the intestine and therefore result in incomplete digestion, even of the digestible food ingredients. In extreme cases, this becomes diarrhea.

Because of unnatural living habits in the past, certain individuals will therefore find that special care is required to regulate the bowel activity. Personal trial is the only way to solve the individual problem. In mild cases varying the amount of whole wheat or bran breads will prove a sufficient means of regulation. If the bread alone is not sufficient, bran as a cereal may be used in addition. When ample leafy greens and fibrous fruits are eaten, less whole wheat or bran may suffice. If the use of all these products results in too rapid passage of the bowel content, then the more fibrous foods should be eliminated and a larger share of the salts and vitamins secured from dairy products.

While the natural foods that are rich in salts and vitamins are usually also rich in fiber, there is enough distinction in the fiber content to permit of personal adaptation of the diet in regard to the cellulose without a return to the white flour and meat diet which is deficient in all of these essentials.

Although the chief element in the regulation of bowel movement is the amount of cellulose or fiber, there is also some difference of effect in nonfibrous foods. Starches are more constipating than sugars, and proteids more constipating than fats. Milk when used in small quantities is constipating, but a full diet of milk is laxative. Sweet fruits are mild laxatives, both because of their cellulose content and because of the sugars. Food oils are laxative if taken in excess because that portion not digested acts as a lubricant. Purified mineral oil is in no sense a food as it is wholly indigestible. Its action in preventing constipation is like that of cellulose, in that it passes through the bowels without being digested.

The term "mineral oil" for use in a food discussion is really unfortunate. This term "mineral" is applied because it is an oil that comes out of the ground and to distinguish it from the ordinary food oils derived from plants and animals. Mineral oil is a petroleum product and is derived by careful distillations from the paraffin type of petroleums—as distinguished from those that have an asphalt base.

This term of mineral oil is used merely to mean that it is a product of the mineral world. Speaking from a strictly chemical standpoint it is not a mineral and does not contain any minerals. It has nothing in common at all with the food minerals. This "mineral" or paraffin oil is composed of nothing but hydrogen and carbon. It is a fuel and will burn in a fire but it will not burn or oxidize in the body. In fact it cannot be digested or absorbed from the stomach or intestines. Even when injected directly into the tissues it is not acted on in any way but lies there as an inert substance. This fact is demonstrated by the use of paraffin by beauty surgeons who sometimes inject it to build up sunken spots in the face. It lies there as a mechanical lump, and may slip about and become a source of hideousness instead of beauty. But it is physiologically inert.

Of these properties we take advantage when we take this mineral oil or paraffin oil into the digestive tract, through which it passes without any chemical or digestive action at all—except the action and effects due to its purely physical properties as an oil and lubricant.

Remember that mineral oil is not a food. While similar in appear-

ance, feel, taste and mechanical properties to the animal and vegetable food oils it differs fundamentally from them in that it is absolutely nondigestible. It plays no part in the chemical functions of the body. It cannot be deposited as body fat because it cannot be digested or absorbed and can never get into the body proper but remains an inert and insoluble substance as it passes through the alimentary canal.

A food is a chemical substance that can be digested and absorbed into the body and play some useful normal part in the bodily functions. A drug is a substance that can be *absorbed* into the body and perform some abnormal and disturbing function. Mineral oil cannot be absorbed at all and so it is neither a food nor a drug.

Mineral oil affects the passage of food and food residues in the intestinal tract in a purely mechanical way. It is primarily a lubricant and softener of the bowel waste. If taken in excess of its mechanical combining power with the digestive wastes it passes from the bowel as a free liquid. In that form the excess does no good and may become a nuisance. Hence mineral oil can be used with advantage and comfort only up to that quantity that can be absorbed by the undigested bowel waste.

For this reason mineral oil when used together with bran or other fibrous material is much more effective than when used alone. Bran and mineral oil are not competitive, but supplementary, means for the overcoming of constipation, and the use of these two products together is better than the use of either alone.

Mineral oil does not interfere with the digestion of foods. The reason it does not is that it does not combine chemically with them but only mixes with them in a mechanical sense. If you put a little mineral oil in a bottle with water and shake it the two will mix, but on standing the two will quickly separate. If you add mineral oil to a dough-batter and mix them the oil will not separate so readily but still it is held in a purely mechanical mixture. Drops of oil are merely entangled in the batter. This is what happens in the digestive organs and the food is digested just the same, leaving the inert droplets of oil.

This theory was tested out by digestion experiments in the Physical Culture laboratory on both men and animals and it was found that mixing mineral oil with foods did not change the digestibility of the foods or affect them in any way. Mineral oil may therefore be mixed with any food and it is better to use a little with each meal rather than to take it separately as medicine is taken. Mineral oil belongs in the kitchen as a food adjunct and not in the medicine closet as a drug.

Bran and mineral oil are the most widely used safe preventives of constipation. Another product that has limited use is agar. This is a gelatinous form of cellulose made from an Oriental seaweed. It is nondigestible and merely forms a harmless bulk in the bowels. The advantage claimed for agar over bran is the fact that agar is a smooth jelly-like substance and is less fibrous or rough than bran. Agar is frequently recommended by physicians for patients whose bowels seem to be irritated by the rougher fiber.

Somewhat similar to agar is psyllium seed, a product that has come into use as a constipation remedy. These small hard seeds when placed for a few minutes in warm water exude a jelly-like substance which seems to be a form of nondigestible gum. The effect is similar to agar and the flavor is less objectionable.

All of these products may be properly conceded to be non-drug remedies for constipation, since they act, as do natural food residues, in a purely mechanical and not a chemical way. Drug laxatives and purges react upon the secretions of the intestines, stimulating a more copious pouring forth of water from the blood stream into the bowel, or causing a purging effect in an effort to wash out the offending substance, and incidentally carrying the half digested food with it. In other words it causes an induced diarrhea which is quite as undesirable as the constipation. Drug purging is harmful and never advisable unless it be as a temporary relief to clear the bowel of some highly offensive accumulation which had no business to be there. The doctor who administers a purge the moment he is called in on a case may produce a temporary and immediate relief, but he cures nothing and unless he advises the patient how to prevent the recurrence is merely leaving a loophole which permits him to be called again as soon as the old cause operates to bring on more trouble.

Adapting the Diet to Various Conditions.—There is no ideal or perfect diet for all people at all times. The fundamental laws of nutrition must be adapted to the varying conditions of life. Let us here discuss these varying conditions, which may be considered as normal variations, as distinct from the application of dietetic laws to actual ill-health and disease, which is considered in other volumes.

These normal conditions are: season and climate, growth and age, sex, pregnancy and nursing, occupation and activity, stature and weight, the influence of diet on the activity of the bowels. Between some of the above-mentioned conditions there are certain interrelations. Thus the chief distinction between the ideal diet for man and woman is

merely one of adapting the food quantity to the difference in size and activity and weight of the body. The chief reason for the modification of the diet with advancing age is that of decreasing muscular activity. The mother's diet during pregnancy and nursing is a matter of adding to the normal diet of woman the essential dietary elements required for the rapid growth of the child that is being nourished by the mother.

In the adaptation of the diet for these various conditions we will have to consider both quantity and quality. Obviously, the adaptation of the diet for variations in bodily size should be a quantitative one, while the distinction in the diet required for growth compared with that of adulthood is in turn qualitative. The adaptation of the diet to muscular activity, and also to old age, is a matter of the quantitative change in the energy-producing content of the food and also a qualitative change in the diet due to the change in proportions of the energy yielding food and the other dietetic essentials.

Food and Season and Climate.—Many erroneous ideas commonly exist concerning the effect of climate and season upon diet. The heat radiated from the body must be furnished by food, and this would indicate that there should be an increase in the fuel food intake in cold weather. But in practice, cold weather results in our wearing more clothing, staying indoors, and decreasing our exercise. Hence, we often require practically no more food in winter, and sometimes less, than in summer.

People who eat all they can in winter but worry over their summer diet have some justification for their pains. The summer diet, because of the greater danger of food contamination and decay, results in more frequent cases of ptomaine poisoning, indigestion and bowel troubles, and the death rate of children who are more subject to such troubles is greater in summer. The man who lightens his summer diet only is usually overeating in winter, and it may not be without significance that the greatest death rate of adults is toward the end of the winter season, after people have been sitting indoors and eating "heavy foods."

There is some justification for cutting down the meat consumption in summer, as the excessive eating of protein (lean meats) results in an increase in body temperature. There is no reason for cutting down on the so-called heating foods—fats, starches and sugars—merely because it is summer. These foods eaten in excess result not so much in an increase of body temperature, but an increase of body fatness. If a man is overfat at any time of the year he is uncomfortable and

inefficient. The fat is more uncomfortable in the summer, and there is more reason for him to reduce, but that is no excuse for his being fat in the winter—it is both cheaper and more comfortable to buy an overcoat than to grow one of blubber like a walrus.

The common, and in general the correct belief is that the diet for growth must contain an ample proportion of the protein foods. This belief originated from the chemical knowledge that the living body, with the exception of fatty tissue, is chiefly composed of protein, and hence, if rapid growth is to be expected, ample protein-building material should be supplied. This chemical reasoning had long been substantiated by the observations that when young animals were supplied high protein diet growth was stimulated thereby.

The general truth of the necessity of protein for growth cannot be disputed either from the theoretical reasoning or practical observation. There are, however, certain dangers in the application of this general principle to the feeding of the children. In the first place, the old school of dietetic teachings laid undue emphasis on the fact that meat was the protein food par excellence. In all old-fashioned food classifications the protein foods were designated as "tissue forming" or "growing" food, and lean meat, containing little else than protein and water, was therefore ranked highest in such classification. Common-sense observations led to the recognition of milk and eggs as more wholesome and digestible protein food for children, and hence these more desirable articles of diet have generally held a high and worthy place in the feeding of children.

But even with this consideration, the danger of the old teaching lay in the fact that the typical diet of meat-eating people was unduly rich in protein, and if special efforts were made to increase the protein in the children's diet above that of the parents, the result would be a far greater proportion of protein than the actual needs of growth demanded.

The danger of error here may readily be understood by the consideration of the slower growth of the human young compared with that of the young of domestic animals. The calf reaches its full growth in two or three years, pigs and chickens in less than a year, while the child requires nearly twenty years for its growing period. Nor do we need to depend upon theoretical reasoning from the fact of the slower rate of growth to reach the conclusion that the child requires less protein than the rapidly growing young animal. The lesson is prepared for us in unmistakable form in the fact that the milk of the

human mother contains but about one-half the proportion of protein that is present in the milk of a cow. This fact is well recognized in the custom of modifying cow's milk for human infants. Such modification is accomplished by taking the top portion of a bottle of milk, adding water and milk sugar. In this manner the percentage of protein from the cow's milk is diluted, whereas the sugar content is increased, and the fat content, because the creamier portion of the milk is taken, remains about the same.

Composition of Mother's Milk.—The composition of mother's milk is indeed the best standard for the diet of early childhood; it is less rich in protein than is cow's milk, and is decidedly less rich in protein than would be a diet of cow's milk to which was added meat and eggs. On the other hand, it would not be safe to attempt to prescribe a diet for children merely by taking a proportion of protein as shown in mother's milk and using this as a standard to select an ordinary diet of vegetables or a diet of vegetables and meat which would yield the same quantity of protein foods. A proportion of protein derived from vegetables and meat that was no greater than the proportion of highly efficient protein in mother's milk, would most likely prove inadequate because of its lower availability.

The body is able to rid itself of food elements taken in excess of its needs, but it is wholly incapable of supplying elements that are deficient. Hence in childhood as in adult life when a mixed diet is used, the exact chemical content of which is unknown, it is essential that the food contain something in excess of the theoretical minimum needs of the body. The diet for childhood should therefore be moderately rich in protein food, and these should be selected from those food groups which most nearly approach the highly efficient body-building protein supplied in the mother's milk. As a source of protein for childhood we must therefore rank cow's milk as that of first quality, and eggs as a second best choice. Beyond this we have little reason to consider the problem, because when these foods are used in moderate quantities the foods added to secure other elements of the diet will contribute such further protein as is required.

But in the problem of feeding for growth protein is not the only essential consideration. The recent discoveries of science have thoroughly established the fact that deficient diets, which have too often resulted in stunted and weakly children, are not to be explained so much by a lack of protein as by deficiencies in mineral salts and the vitamins. The highly beneficial results of the use of milk in feeding

children are to be explained by the presence in a highly assimilable form of these dietetic essentials. Calcium (lime) and phosphorus are the mineral elements most likely to be deficient. These are supplied most abundantly by milk. Eggs alone are not so complete a diet for growth because of the fact that we do not eat the egg shell from which the growing chick secures a large portion of its calcium. Eggs cannot therefore be considered so complete a growing food as milk, although they are infinitely superior to meat or vegetables as a source of protein.

By the supplying of a liberal proportion of milk to the diet of childhood the chief danger of malnutrition is avoided. As the quantity of milk is decreased and the proportion of energy derived from other food is increased, care should be taken that mineral salts and vitamins are supplied in like proportions. This factor of safety can be assured by the free use of green vegetables, fruits and entire grain products.

The chief dietetic danger of childhood comes from the child's fondness for confections, cakes and pastries made of white flour, sugar, starch, glucose and fats. Such denatured or superrefined foods are practically useless for supplying the elements of growth. Theoretically they are not harmful in small quantities, but in practice their use cloys the child's appetite so that he under-eats in foods containing mineral salts and vitamins, and there is grave danger that the proportion of these highly important dietetic essentials will therefore be decreased below the line of safety.

The first essential of the growing-diet of childhood is the inclusion of milk and eggs for the supply of the most efficient growing protein and for the certainty of a supply of minerals and vitamins in their safest and most utilizable form. The second most essential consideration is to include green vegetables and fruits so that as the proportion of milk is decreased dietetic habits may be formed which will continue the supply of these essentials. Third, the inclusion of whole-wheat bread and whole grain cereal products, such as oatmeal and unpolished rice, in preference to white flour, polished rice and denatured patent cereal foods. Fourth, if the child is raised at a meat-eating table it should be taught to eat meat in very moderate quantities and not be allowed to make it the main dish of the meal. Fifth, the use of sugar and confections should be discouraged and the natural taste for sweets should be given a proper expression by permitting a free use of raisins, dates, oranges and other fruits that yield natural sugar in combination with mineral elements in an undenatured form.

Diet According to Age.—Taking first the question of quantity, we find that the amount of food should be greater, considering the size of the body, in youth and slowly decrease with age. The new-born infant eats far more per pound of body weight than the full-grown man. This is true, first, because of the more rapid growth, second because of the radiation of heat relatively greater from the smaller body, and third because the general rate of organic activity is greater. The heart-beat and the breathing is faster in the child, and its activities are more constant. Small animals eat more per pound body weight than do the larger species.

After physical maturity the quantity of food needed is fairly constant throughout adult life and is much more influenced by activity than by age. As old age approaches the quantity of food required gradually decreases, due chiefly to cessation of activity and also in part due to the shrinkage of the quantity of muscular tissue. Of all the known rules for attaining long life that of an abstemious diet is conceded to be the most important. As age increases the dangers attending overeating become greater. The old man not only fails to take the vigorous exercises of the younger, but he moves slowly, and all his bodily actions are slowed down and require less energy for their continuance.

Diet According to Occupation and Activity.—Muscular activity, whether of work or of play, is the greatest factor in altering the food requirement. A man doing no active muscular work and taking only light exercises, requires less than one-half the amount of food that he would need if he were working to the limit of his muscular capacity. But such extreme muscular work is comparatively rare and called for in but few occupations.

A man at heavy labor can, without apparent harm, eat foods which would wreck the digestion of a man at light labor. If the lumberjack eats from one to two pounds of meat per day, it is his work that makes possible such eating and not the eating of the meat that makes possible his work. What is good for a man at moderate labor is still good for a man at heavy labor, but there are food elements that extra labor need not increase. The body requires practically no more protein, salts or vitamins, for heavy labor than for mere existence. Because cereal foods are cheaper, the manual laborer is fortunate in that the demands of his work do not require an increase of protein as was formerly thought to be necessary.

Extra muscular activity requires extra food for energy only, hence

cereals, sugar and fats are all that need to be added to a diet that already has enough of the other food elements to support normal life. In practice, in the poor man's home, this means a heavier consumption of the cheapest dishes. But it is well to note that the laborer's wife and children will need the same food proportions as other people, and hence the heavy worker with his workman's appetite, should partake of the low cost dishes and indulge himself in the daintier dishes only with such appetite as is expected of a man at light labor. This withholding from the head of the household the better tasting food may seem a difficult business in some instances, yet if we will stop to think it is what is commonly done in every household where bread and potatoes are piled on the table unlimited, and desserts served in limited and equal portions to all. The foods that are most needed to round out the diet made of the low cost cereal and fat dishes will be fruits, milk, eggs, and vegetables, especially the green salads. If the family is hard pressed for cash it may be well if more of these dishes are served to wife and children at the noon or afternoon lunch when the father is at work. Usually father won't mind it a bit, for he wants something "filling."

Because muscular activity stimulates the appetite there is often a tendency to allow a small increase in muscular work to result in too large an increase in food consumption. The following estimates will serve as a guide for the increasing of the diet with labor. It is, of course, only approximate, as the amount of muscular labor in any occupation varies widely.

A man of average size and weight when resting in bed (as from a broken leg) will require 1600 calories.

When on his feet and up and about the house taking absolutely no other exercise, 2000 calories.

When engaged in office work taking exercise equivalent to walking two miles a day, 2400 calories.

Indoor clerks on feet all day, 2600 calories.

Light factory labor, chauffeurs and teamsters, 2800 calories.

Carpenters, plumbers, expressmen, 3000 calories.

Walking all day as in following a plow, 3200 calories.

When engaged in harvest work, as shocking grain or pitching hay, including both continual working together with constant stooping or lifting for long hours, 4000 calories.

When lumbering, ice harvesting or engaged in similar excessively hard labor outdoors in cold weather, 4500 calories.

Six-day bicycle races and other deliberate efforts to utilize man's muscular abilities to the limit, 5000 to 6000 calories.

It is to be borne in mind that such feats as six-day bicycle races usually result in the consumption of stored bodily fat. It is very difficult for the body to digest and assimilate such quantities of food even though the muscular consumption for the time demands it. In England, an experiment was once made to see how much men could eat and what would be the result of such deliberate over-eating. Healthy men taking outdoor exercise were used as subjects and were able to stuff themselves with 5000 calories per day. In every case they broke down in a few weeks with digestive disorders, and usually lost heavily in weight before recovery.

Food for Mental Activity.—To find a special diet for brain workers has long been one of the aims of science. This search has reached no definite goal. It has long been known that the brain cannot work efficiently if the general health is in any way depleted. But scientists have not been able to find any particular food that would make a man think.

A proper understanding of the physiology of thinking indicates the futility of a search for brain food. Muscular work converts matter into energy, but mental work consumes no appreciable quantity of matter. As thinking consumes nothing, there is no food that can create thought. This brain tissue is renewed but slowly and its composition cannot be materially changed by particular foods.

Experiments in fasting demonstrate that the power to perform intellectual labor not only does not depend upon the amount of food eaten, but within certain bounds, *is dependent upon the ability of man to do without food.* In other words, the longer he fasts within certain bounds, the greater becomes his intellectual power and the clearer his intellectual vision. Yet it is self-evident that if this idea is carried to the extreme and the man fasts to the point of physical exhaustion he is then unable to utilize his power of thought to any practical purpose. Hence, the "golden mean" must be observed. A sufficient quantity of food should be taken to maintain physical vigor at its highest degree of efficiency without overloading the body with unnecessary and undigested foods. Experience, then, demonstrates that the brain and nerves, when the proper degree of rest is given them, will recuperate themselves from the stores found in abundance in a healthy body, and will thus keep the organs of the mind in a condition fit for the highest intellectual manifestations.

While there is no particular food that can be eaten to aid the working of the brain, there are very many nonfood materials that may be taken to injure its functions. Alcohol is a brain poison, the action of which is obvious. Nicotine, caffeine, and the various habit forming drugs also affect the brain. Any dietetic error that results in autointoxication destroys mental efficiency. The mere eating of excessive food produces a condition of the blood which results in dulness and drowsiness. Very many ways of eating will interfere with clear thinking, and chief among these is gluttony.

Comparative Dietetic Needs of Men and Women.—Except in child-bearing or nursing periods the chief distinction of woman's diet compared with man's is merely that one due to her lesser physical stature. Hence the proportionate differences would only apply in comparing a particular man and woman whose difference in size are relatively the same as the average differences of the sexes.

The dietetic requirements of women are usually placed at four-fifths those of men. If woman was engaged in as great a physical activity as man this would be a correct estimate. However, woman's smaller size and less active life, together combine to make her food requirements relatively small, and in many families where the husband works in active labor the wife might overeat and the husband under-eat, when she was not consuming more than half as much food as he. This is no argument to deprive woman of her fair share of food, for in practice, its application will result usually in restoring her to health, as woman suffers more frequently than man from indigestion or over-weight, due to a combination of heavy eating with light muscular activities.

Woman's work may be very wearisome, literally the back-breaking sort, but the maintenance of an uncomfortable position or exhaustion from working in a hot and humid kitchen is not the sort of work that requires a heavy intake of food.

Woman's weight averages 83 per cent. of that of man, but her food requirements are not as much in comparison, because of the fact that woman's muscular system is not 83 per cent. that of man's. If it were, she would truly be more muscular for her size than man. The average woman carries more fatty tissue than man as shown by comparison of their statures. The weight of a body is as the cube of the dimensions and so figured woman's ideal weight should be only 77 per cent. of man's.

Under average conditions there is also a qualitative dietetic differ-

ence indicated for the sexes due to the fact that the average woman *does* carry more fatty tissue and that she does exercise relatively less, hence she will need a somewhat larger portion of the body-building and vitality-yielding elements of food and a comparatively smaller portion of the heat and energy supplying food elements. Her diet should therefore be more like that of the child when this is contrasted with that of the adult and particularly that of the hard-working man. If a woman is overweight or especially inactive this difference should be increased, but where the weight is excessive the diet should conform more nearly to that recommended for the reduction of obesity, which is distinguished from that of the best growing diet of childhood by a lesser proportion of the growth-protein derived from milk and eggs.

Although gluttonous appetites may be more common among men than among women, there is probably a larger proportion of women who overeat than of men. This fact can be explained by the corresponding fact that a larger proportion of women are under-exercised. It may also be due to habits of serving food in uniform portions which particularly applies in case of dining in public restaurants. A woman of average size and activity who eats the same quantity of foods as the average man will in nine cases out of ten be overeating. As it is often impractical, particularly in dining out, to have food portions served to individual needs, a woman will do well to omit some items from a dinner as served to the heartier eating man. Certainly such a course is in better taste than the habit of ordering the full service of food and leaving a portion uneaten. The plan of omitting some dishes from a full dinner also gives the intelligent woman a chance to exercise some selection in her food without the necessity of appearing unduly finicky or cranky. The items which she should omit from the conventional meal would ordinarily be those dishes richest in carbohydrates and fats, and this first would apply particularly in the case of the woman who is inclined to carry more weight than the laws of health and beauty demand. It should be noted here that all cases of overeating do not result in overweight but with some individuals may cause indigestion and actually result in underweight. In either case the thing to do is to eliminate the heavy starches, meats and rich sweets and pastries.

Diet During Pregnancy and Nursing.—Diet for the woman who must eat for her child as well as for herself is essentially a diet for growth. The ideal diet for the woman not doing heavy

physical labor is closely akin to the ideal diet for the child, hence the primary need for the mother and the secondary needs for the growth of the child may be combined harmoniously. The additional amount of food that must be eaten to provide for the growth of the child is relatively small as the child's growth is comparatively slow. During the nursing period the total demands will be somewhat greater than during pregnancy.

But while the additional amount of food which the pregnant or nursing mother will require is not great, it is highly important that the diet be of the finest growing quality and amply and richly supplied with high growth protein and with mineral salts and vitamins. Milk, butter and eggs should enter in reasonable proportions into the mother's diet. Fruits and leafy vegetables are highly desirable. Sweets, preferably in the form of fruits and honey, are a desirable source, not only for supplying energy to the mother during pregnancy and nursing, but as a source of milk sugar.

The healthy and well-fleshed adult carries a reserve store of many of the food elements which will bridge over periods of dietetic deficiencies. But if the mother's diet is deficient the growth of the child will make the first demands on the lacking elements and the mother's vitality will suffer accordingly. If the deficiency is not remedied, both the mother and child will suffer, but the mother will have more opportunity to recover, whereas the child's growth may be stunted or a weakness may result in the rapidly developing young life which cannot be so easily remedied at a later date.

Starches may enter into the mother's diet more largely than they would in the diet of the young child, as her digestive powers are better able to cope with them. The same is true of meat, although there is positively no advantage of meats over milk and eggs and if the latter are available in abundance there is no occasion for the mother's becoming a heavy meat eater at this period.

After childbirth, if the mother is thin, and especially if she is doing heavy housework, her diet may approach that of the male standard in quantity, but if she has retained her plumpness, or when she regains it, there would be no occasion for a heavier diet than that maintaining normal bodily weight.

Appetite may be more safely relied upon to indicate the quantity of food needed than to indicate the quality. This particularly applies to the modern civilized diet in which such natural instincts as man possesses are more or less baffled by habits of eating artificial food forms

and mixtures. Scientific knowledge and intelligence are absolutely essential if modern civilized man would reach the maximum of efficiency in diet and this principle applies to the pregnant or nursing mother more especially than to other people at other times, because a deficient diet at this time is a source of greater danger.

The young child, whether in the mother's womb or nursing at her breast, is living its small life at a relatively more rapid rate than is the adult, and dietetic deficiency will therefore more quickly result in impairment of growth and vitality.

PART 3

HEALTHFUL COOKERY

THE most healthful dishes and the most palatable dishes are not necessarily the same—nor are they always different. Some of the most wholesome foods are the most palatable; certainly ripe fruit comes in this class. But some of the least wholesome foods are also considered quite palatable—plum pudding and mince pies might be mentioned as generally accepted examples.

We can, therefore, have four kinds of cookery: First, tasteless food that is unwholesome; second, tasteless food that is wholesome; third, tasty food that is unwholesome; and, fourth, the ideal food that is tasty and also wholesome. This makes three wrong ways of cooking and only one right way.

The cook cannot create chemical elements and, be she ever so skilled, she cannot make a wholesome diet out of sugar, coffee, white flour, meat, potatoes, corn meal and lard. These food substitutes, with the exception of coffee, are harmful to health, not because of what they contain, but because of what they lack, being deficient in essential food elements which no cleverness in cooking can supply. Potatoes are the least objectionable item in the list, and may be counted upon not to make the diet any worse; but all the other items require to be bolstered up with more vital foods if they are to be used at all.

There is also the question of the food quantity, wherein the cook is only partly responsible. If people will insist on not eating enough, or eating too much, the best cooking in the world cannot save them from deficient nutrition or health-destroying poisoning from excess food.

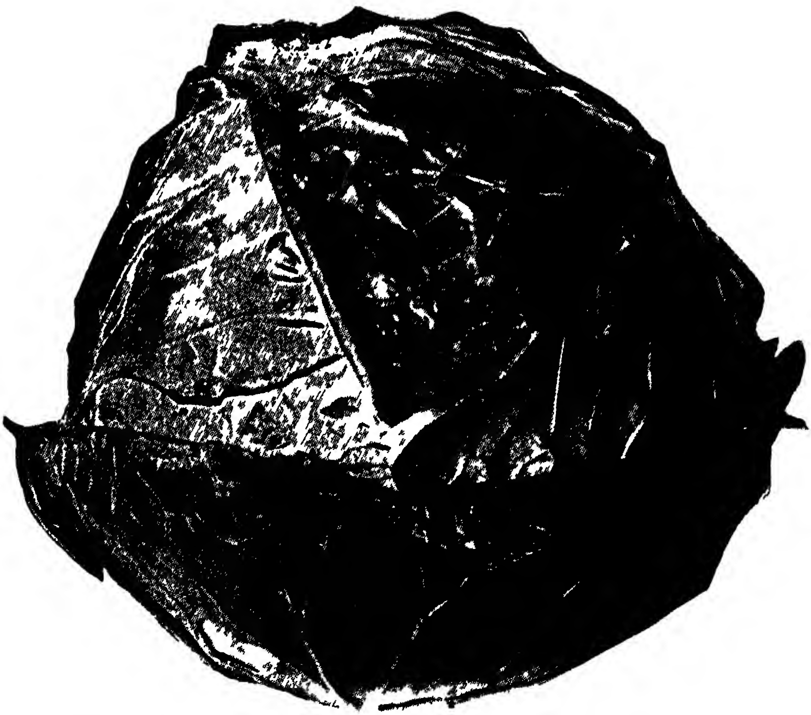
In all justice to that much-abused person, the restaurant cook, it should be said that though his cooking were perfect his customers might still ruin their digestions by choosing their orders badly, eating wrong quantities and eating in a wrong manner. The wife and mother who is food buyer, cook and hostess has an opportunity to be also health director to her family. As such she can select, cook and serve foods for health.

She can choose the original food materials properly; she can serve

them to the various members of her family in approximately the correct portions for their individual needs; and she can discourage the tendency to bolt the food, not only by serving the meal in deliberate fashion and providing something to chew on in at least a part of the bill of fare, but also, when necessary, by direct admonition

Balancing the Diet.—It is unwise, from a practical point of view, to try to make every recipe or even every meal chemically complete. From among a thousand recipes, all good for their purpose, it would be possible to select a diet that would be incomplete and unbalanced, and for that reason let us review briefly the chief points that must be kept in mind in selecting a diet capable of maintaining the highest degree of health and strength.

The most abundant nutritive elements, and the ones of which we require the largest quantity, are the fuel foods. These foods are oxidized or "burned" in the body, producing heat and energy The fuel foods are fats, sugars and starches. We should eat enough of



In modern nutrition, cabbage is highly rated and considered especially valuable for its high mineral and vitamin content.

these foods to keep up an ideal body weight, but anything over the amount required for that purpose is worse than useless. Since fats, sugars and starches form about nine-tenths of the entire bulk of our food, we can approximately judge the total quantity of the food we should eat by the effect on the body weight. Hence, the good cook must watch the weights of all members of her family.

In addition to the fats, starches and sugars, which are fuel and fat-forming foods only, there are several other elements in foods which, while required in smaller quantities, are absolutely essential to life and health. These substances may be roughly classed in three groups; the proteins, the mineral salts and the vitamins. Protein is the building material of the body. Active tissue is practically all protein. Growth cannot take place unless this protein is supplied, nor can life be continued without growth unless the waste of the active tissue is renewed. But the quantity of such actual building material required is not great. There is less danger of there not being enough of it than there is of its being poor in quality.

Mineral salts and vitamins are required in still smaller quantities, but that small quantity is absolutely essential, for without these substances the highly complicated life process cannot go on. The special significance of vitamins and minerals to the cook lies in the fact that though they be present in the foods she buys, she can by wrong methods of cooking lose or destroy these vital elements.

The cook must also remember that refined white sugar has no vital elements in it.

Mineral Salts and Cooking.—There is no reason to believe that the ordinary processes of cooking ever destroy or even impair the nutritional value of any food minerals. In fact the minerals are, of all food elements, the least injured by heat and the most difficult to destroy. Indeed if food is burned up in the ordinary sense that wood is burned, the minerals remain in the ash and so are the only thing about food that heat does not destroy.

In the case of that much heat, some of the mineral values would be impaired or destroyed because the forms of chemical compounds or mineral salts would be profoundly changed, most of the minerals that had been in other combinations being oxidized or changed into oxides. But even in such food ash, the minerals retain considerable nutritional value, and milk ash is frequently used in dietetic experiments to supply food minerals. It was by such experiments that vitamins were discovered.

This explains the confusion about the effect of heat on mineral values, or the minerals in "organic combination." Milk ash when recombined with milk protein, fat and sugar does not make milk again and will not support life. That fact led to the belief that the heat and oxidation had destroyed the value of the minerals, which on the evidence seemed to be proved. But it was the vitamins—at the time unknown—which had been destroyed, and the milk minerals were still good when new sources of vitamins were added.

The ordinary heat of cooking results in a varying degree of destruction or impairment of the various vitamins, but has little or no effect on minerals. But there is another factor of the loss of minerals from use, in which they are not destroyed or even oxidized, but are merely washed out and thrown away. That occurs when any finely divided or cut up vegetables are boiled and the cooking water is not consumed. About half as much loss occurs when vegetables are steamed, the steam condensing on them and running off as water. When one is making a stew or soup and the liquid is to be consumed there is no practical loss, for there is no destruction or even impairment of mineral food values by cooking but only a solution or washing out of

The tomato ranks high as a source of vitamin C. The A and B vitamins are also supplied by the tomato.

the minerals. The simple business of cooking a piece of salted meat in soup and thereby salting the soup should make clear what happens.

Rendered or extracted fats, whether of vegetable or animal origin, are devoid of any food element except the pure fat. White flour is not quite so completely denatured as sugar and lard, but its use is more likely to render the diet deficient as a whole, because it forms a large proportion of the total food intake. Polished rice and degerminated corn meal are in the same class as white flour, and their use is equally dangerous when they form a large bulk of the diet. Corn syrup is also wholly denatured, as it is made from pure starch.

In addition to the chemical deficiency, that is, the lack of salts and vitamins, these denatured foods have two other faults. The first is that they make dishes which require little or no mastication; and the second, which is closely related to the first, that they contain little, if any, fiber or "cellulose." When this fiber is removed from the diet, the food residue is so reduced in quantity that it does not move freely, and the poisonous wastes of digestion are not removed promptly enough from the body. Therefore, the conscientious mother cooking for her family must know the individual member's status in relation to the problem of constipation.

Denatured foods are not really harmful for what they contain, unless eaten in excess, but they are always harmful to the extent that they crowd more natural and more vital foods out of the diet. Hence, the cook, who is the director of the health of her household, must not only maintain in meal-planning a balance of the more vital foods and the mere fuel foods, but she must see, especially in case of children, that her work is not undone by wrong consumption at the table.

The denatured foods are so well established commercially, and our methods of cooking are so much based upon them, that it is difficult to avoid them entirely. It is not necessary to do so if they are used together with other foods that are particularly rich in the elements in which they are lacking. The foods that possess a superabundance of the vital elements have been called "protective foods." The best protective foods are whole-wheat products, milk, butter and eggs, leafy or green vegetables, tomatoes and citrus fruits.

White Flour.—We are all creatures of habit, and it is difficult to break off entirely from the articles of diet to which one is accustomed. One must recognize that many clever effects in cookery can be secured by the use of denatured foods. Indeed this fact accounts for their wide adoption and general use.

Thus very effective arguments for white flour lie in the fact that it makes light bread, and that it is difficult to make nice cakes or pies without it. In other words, "lightness" and "whiteness" are its chief advantages.

The lightness depends on the presence of a protein substance called gluten which is viscous, or gummy, so that it holds the dough together and prevents the escape of the gas bubbles which make it "light." This same gluten is retained in whole-wheat flour, but the bran gives it a granular effect and allows more of the gas to escape; hence whole-wheat breads cannot be made quite as light as white-flour breads. The nearest substitute for wheat gluten in this respect is eggs, which are commonly used in baking to give lightness to cakes and corn bread.

The health-seeking family should get into the habit of using whole-wheat flour, and making white flour the exception, instead of the rule. There are a few things like angel food that cannot be made satisfactorily out of whole-wheat flour. There are also many things in which flour is required, but only a spoonful or so; then it will make no particular difference which kind is used. Since the white flour is objectionable for what it lacks, and not because of any harmful element it contains, we need not eschew its use altogether. The important thing is to use the more nourishing whole-wheat in those foods which call for flour in quantities. This, of course, means chiefly breads. However, many of the cakes, cookies and pastries usually made of white flour are as good, or better, when made of whole-wheat flour. Pie-crust can be made of whole-wheat flour, though it is a little difficult.

There is no harm in using white flour in small quantities in a diet that contains an abundance of other foods that are rich in the minerals and vitamins which the white flour lacks.

Spoiling Good Foods with Bad Cookery.—While it is a matter somewhat in dispute as to how much cooking affects the chemical composition of foods, we know without consulting a chemist that cooking very materially affects their digestibility.

Soggy dough is indigestible. In a few cases by intention (dumplings for example), and more frequently because of failure in cooking, we are served with heavy, gummy masses of dough. White flour is the chief offender in this respect. Almost any white-flour bread-product can, when warm, be made into a dough-ball which is impenetrable to the digestive juices.

This condition is due to undercooking, insufficient leavening, or too much water. Corn meal and whole-wheat products may be as "heavy," but they never form such a sticky, dense mass, because their granular composition makes them more crumbly.

Fat and sugar both emphasize this defect, and a soggy cake is worse than soggy bread. The greatest offender of all is the notorious plum pudding, in which the packed mass of sugar, fats and flour is cooked in boiling water until it becomes almost as indigestible as chewing gum. Fat and starch combinations are none too digestible at best, but they are worse when they are soggy.

The Question of Fried Foods.—Frying as a method of cooking has been generally condemned from the standpoint of wholesomeness. Undoubtedly the coating of food elements with hot fat does not improve their digestibility. But the degree of harm that comes from frying depends on how it is done. The mere greasing of a griddle or skillet to keep food from sticking while cooking does not work any particular injury to the food, and, indeed, a like process is necessary in most baking operations. On the other hand, certain foods can be fried in deep fat in a way that quickly coats the foods over so that they do not become thoroughly grease-soaked.

The intermediate stage of frying in shallow grease, or of frying crumbly substances that soak up large quantities of grease, is decidedly objectionable. With a few exceptions, such as French-fried potatoes, I would caution you to use the smallest amount of fat in frying that will keep the food from sticking to the skillet or griddle. The use of a good spatula, or pancake-turner, will greatly facilitate operations, and after a little practice you will find that you can fry foods without having them soaked with grease.

Butter and the various vegetable fats, both solid and liquid, are the most wholesome fats to use in frying, besides having the best flavor. The notion that lard is the most satisfactory cooking fat is a prejudice, having no more foundation than the idea credited to the ancient Chinese who are said to have believed that the only proper way to roast a pig was to drive him into the house and set fire to the house.

Excessive Use of Sugar.—The sugars form a considerable bulk of the natural diet of man, and our love for sweets is founded on physiological needs. But there are several kinds of sugar which differ slightly in chemical composition and also in sweetness. The most abundant sugar in the natural diet is dextrose, and this is the kind of sugar that exists in the blood and is essential to our physiological

processes. Other sugars must be reduced to this form before we can assimilate them.

Sucrose, commonly called cane sugar, made from either cane or beets, is probably the least wholesome of sugars; yet by its excessive use we cultivate an exaggerated or depraved taste for sweets. The excessive use of cane sugar has been demonstrated to be harmful. Laboratory animals do not thrive as well on it as they do on milk sugar, or dextrose, or even upon starch. Thus we find additional reason for discouraging the use of cane sugar, besides the fact of its being denatured, or separated from all other nutritive elements except the pure carbohydrate.

In the manufacture of commercial sugar the sweet juice of the plants from which it is made (sugar-cane and beets) is first concentrated and then "purified." The purifying process removes everything but the chemically pure sugar. The mineral salts and vitamins present in the natural juice of the plant are thus discarded and destroyed, and we are given a denatured product.

Brown sugar is less objectionable and deserves wide use. The more refined sugar we use the more deficient the diet becomes. The evil of candy-eating, especially by growing children, is that they fill up on candy between meals, and as a result fail to eat enough of the more complete and nutritious foods offered them later. The advisability of giving candy to children at any time is questionable. It is far better to satisfy the craving for sweets with honey, raisins, dates, figs and other sweet fruits. If they must have candy, however, give it to them as dessert at the end of a meal and not between meals.

The excessive use of sugar in cookery has the further fault of creating a taste for sweet things that dulls our appetites for more natural flavors.

Pepper and Other Spices.—These artificial flavors have the fault that we have attributed to sugar, and they do not even have the redeeming feature of being nutritious.

Hot spices, of which pepper is the most common, add no food value whatever. Their use is a habit almost as artificial as the use of alcohol or tobacco. They are not beneficial to anyone, unless it be the vendor of inferior foods, who is thus enabled to cover up the tastes of things that would otherwise be rejected as unfit for consumption.

The flavor of spoiled foods can thus be covered up; so can the

flavors of good foods. There are very few foods which do not taste good to a hungry man with an unspoiled sense of taste without the addition of any artificial flavoring. But when a man has been in the habit of peppering and spicing everything he eats until his sense of taste is deadened to anything that does not almost burn his tongue off, he naturally finds unpeppered foods flat in taste.

The trouble with this habit of overseasoning all foods, is that such instincts as we have to guide us in our eating are destroyed, and we have no natural way to tell what to eat or when to quit eating.

One must concede a reasonable amount of seasoning used to give a variety of flavor. The folly is in seasoning everything alike and everything too much, so that there is nothing left to taste but salt and pepper, sugar and vinegar, and we have to use our eyes to tell what we are eating.

The Use of Salt in Food.—Most people oversalt their food. Many published recipes give a quantity of salt as an ingredient that would make them too salty even for the taste of those who like their foods salted.

This latter fact is due to the lack of adequate facilities for measuring small quantities in the kitchen. The teaspoon is the smallest available measuring unit, and the writer of recipes therefore says: "One teaspoonful of salt." In practice this same cook would not add a full teaspoon of salt, but would guess at it, and usually use less. The same with pepper and spices. These small quantities can be better judged by the eye than by the spoonful.

Knowing the above difficulties some cook books avoid attempting to give quantities for such ingredients, and say: "Salt to taste," or a "dash of salt," and a "dash of pepper." Such phrases mean nothing except to put in as much as common sense and experience indicate.

The salting problem might better be left to the cook's judgment and memory. The truth is that eating food salted or unsalted is a matter of habit. Jewish people use unsalted butter. Certain families never salt bread. When you are used to salt, or the lack of it, in any type of food, having it the other way seems wrong.

A good rule is to salt only those types of food which you find are the least palatable to you without salt.

As a matter of fact some salt is essential to life. The source of the hydrochloric acid in the gastric juice is the chlorine of common salt. But foods in their natural state contain some common salt. The

quantity thus supplied may or may not be enough, depending upon the type of foods used. The instinctive craving for salt on the part of many animals and of races of men is seeming evidence that the quantity of salt in the natural vegetable foods is rather low.

But because salt is necessary to life and we have an instinctive taste for it, is no reason why we should salt everything we eat to the limit. The conventional salted diet undoubtedly contains many times as much salt as is really needed for the physiological processes; there is practically no danger of your being short of salt for the real needs of your body, even if you never added any in cooking, for the reason that many of the food preparations you buy have it added in manufacture.

An excess of salt may be injurious to health, but also that such a use of this accessory, as of hot spices, disguises the real taste of food, interferes with our true food instincts and encourages overeating and careless eating.

You need not make a fetish of avoiding all salt, but don't allow yourself to get into the habit of being unable to eat food unless it is salted.

Denaturing Food by Cooking.—The all-important natural salts and vitamins which the miller and the candy-maker remove can also be removed by bad methods of cooking. When you pare potatoes, and then put them in a big pot of water and boil them, and then discard the water, you are doing just what the miller does when he grinds wheat and bolts out the bran and germ. In both cases the consumer gets only the denatured starchy residue.

The livest part of the tree is the inner layers of the bark and the sapwood which lies just beneath the bark. This principle runs through many plant forms, particularly in the case of seeds and roots, or grains and tubers. In removing the outer coverings of such things, therefore, good food will be lost, unless one can do this in such a way that the part which lies directly beneath the outer layer is not disturbed; and, in the case of boiled foods, the removal of the rind covering permits the water to leach out soluble salts and vitamins.

The old slipshod method of boiling vegetables in a great quantity of water, and then fishing them out and discarding the water, is no longer considered good cookery.

Not only is much flavor lost in this fashion, so that the vegetables are served in a tasteless, washed-out condition, but we now know that

much of the most valuable nutriment is also lost. The loss is greater if the vegetables are cut up before boiling

There are, however, a few exceptions to the rule against boiling vegetables in water which is to be discarded. Potatoes, sweet potatoes and beets may be boiled in their skins, and when they are done the thin outer coverings can be removed without much loss of the nutritious substances underneath. The most careful guarding of these substances would require that the vegetables be boiled only to the point necessary for the removal of the skin, and that the cooking be finished in some other manner; but this is not very practical, and the loss by the former method is not sufficient to be serious.

Another exception is that of kale, dandelion and certain other strong-flavored greens Here the soluble extracts are sometimes so strong as to be unpalatable In this case it is best to discard the cooking water It is true that valuable salts are lost in this way, but the greens are so rich in these elements that they can stand the loss. One would prefer to use the tenderer, milder varieties of greens which are palatable without such discarding of the liquor, but these may be unobtainable.

Onions are of moderately high protein content. They supply vitamins B and C. Phosphorus and calcium and a slight trace of iron also are among the nutritive elements of the onion.

The methods of cooking vegetables in which there is little or no loss of nutrients are as follows:

Baking.—An excellent way of cooking such vegetables as are at all adapted to it, as there is no loss of substance and the flavors, too, are agreeably retained. Potatoes, squash, parsnips and bananas (essentially vegetables in their composition) are best adapted to baking. Ears of corn, when rather mature, may be baked or roasted.

Baking in Casserole.—Almost any kind of vegetable can be cooked in this way with very satisfactory results. The effect is that of boiling in the natural juices, sometimes with a little added liquid. The even heat of the oven all around the container cooks the food without the burning on the bottom which would be almost inevitable in any attempt to boil it, with the same quantity of liquid, on the top of the stove, where only the bottom of the dish is heated. Nothing is lost and the maximum flavor is retained. This method of cooking vegetables is too little known and used.

Steaming.—This method of cooking retains most of the soluble nutrients, but in some cases the volatile flavors are lost. Steamed foods are always nutritious and wholesome, but may be a little flat in flavor. Roasting ears of corn are much better when steamed than when boiled in water.

Steam-pressure Cooking.—This method requires the special pressure cooker. It is superior to open boiling both in cooking more quickly and in retaining volatile flavors. The only objection to it is the cost of the apparatus, for it has been proven to be no more destructive to vitamins than boiling and, in some cases, even less so. The temperature is higher, but it is not continued so long and there is less exposure of the food to the influence of oxygen.

The Double Boiler.—This method is similar to steam cooking, but in this case the food can be cooked in a small quantity of liquid, which is to be retained, without any danger of sticking or burning and the consequent ruin, not only of the juices, but of the solid part as well. Not all vegetables will cook quickly enough in a double boiler, but this difficulty may be largely overcome by bringing the food to the boiling point on the stove while the lower pot of the double boiler is being heated, and then finishing the operation in the upper pot.

Boiling and Using the Juices.—With peas, corn cut from the cob and tomatoes, the cooking water or juices are always served. But in the case of string beans, carrots, turnips, cabbage, beets, etc., this

liquid is frequently discarded. In practically all cases it should be retained and used in some fashion. In the case of vegetables which have plenty of surplus flavor, the boiling liquor may be used separately as the base of soups. If this is to be done, use enough water so when the cooking is finished there will be just the right amount of liquid to make the soup.

Fruit juices are almost always served without any addition whatever except the sugar used to sweeten the fruit, and vegetable juices may also be served plain when they are found palatable. In other cases a simple sauce may be made from them by adding butter, milk or cream, starch or flour, or any combination of these.

Some experience in cooking is necessary in order that one may know just how much water to use so that the juice or sauce will be of such a strength as to be pleasing to the palate.

In whatever way the juices are to be utilized, one should be careful not to use too much water. Rarely, if ever, in the case of fresh vegetables, is it necessary to entirely cover them. Cook in a closed vessel and let the steam do most of the cooking. Boiling hard is a meaningless operation; boil just hard enough so that a small amount of steam escapes.

Frying.—Many vegetables that cook quickly, such as onions or cabbage, may be boiled and steamed in a skillet with the lid on. Use only enough water to cook them, and as this boils down add a little oil or butter and stir a bit. This is not really frying, for the vegetable is cooked in water and its own juices, and just enough fat is added to prevent sticking as the juice boils down. So prepared nothing is lost, and the slight frying and browning at the end of the process gives a different flavor from that of the plain boiled vegetable.

Cooking and Flavor.—The chief purpose of cookery as an art is the development of flavor. The flavor of some foods in their natural condition is such that it can not be improved by cookery. But other wholesome foods have, naturally, very little power to please the palate. The great problem of culinary economy is to take such simple foods and so treat and combine them with more highly-flavored ones that they may become acceptable to the taste.

Flavors may be classed as follows: (1) Flavor of the food in the raw state; (2) flavor of the same food as altered by cooking; (3) flavor gained by the addition of seasoning which has little or no nutritional value; (4) flavor gained by combining foods.

The natural flavors of foods need no discussion, but a warning

against the practice of spoiling them by unnecessary cooking. This was the error of the inexperienced cook who baked the watermelon.

There are many foods which have one flavor uncooked and an entirely different one when cooked. A pleasing variety can be obtained by serving them in both fashions The banana is a good example. Many people never think of eating it any way but raw; yet cooked bananas are fine. Oranges are so good raw that we rarely think of eating them any other way; yet orange marmalade is a delicious confection, and, though it sounds luxurious, a very economical one. Farm-bred families who, on moving to the city, find the products of the manufacturer, by reason either of their abominable quality or excessive price, a poor substitute for the jellies and preserves of the old regime, might profit by this suggestion.

Onions furnish an excellent example of a strongly-flavored food which is greatly changed by cooking. So different, indeed, is the flavor of onions raw and cooked that both are sometimes used in the same recipe to give two distinct flavors.

The following vegetables may be used both raw and cooked: Cabbage, onions, tomatoes, turnips, carrots, kohl rabi, celery, peppers and cucumbers and cauliflower. The last items may astonish American cooks, but abroad cucumbers are commonly eaten cooked. They may be sliced and stewed, and served with butter and milk like asparagus, or they may be dipped in flour and fried like eggplant. By contrast many people only use cauliflower cooked, whereas it is excellent raw in salads.

If you like one vegetable cooked in a certain way, try a similar vegetable cooked in the same way. Try also to see how many vegetables you can learn to like in raw salads. The vitamin content of vegetables is at its best in the raw state, and, in the treatment of various diseased conditions, results that seemed almost magical have been achieved by diets of which raw vegetables formed the chief part.

Among flavoring materials that add little food value those most commonly used in America are salt, pepper, vinegar, mustard and a half-dozen or so spices.

Other nations add to this list of undesirables. Curry powder is the great flavor of India, while chile peppers are the essence of much Spanish and Mexican cookery.

A group of food flavors which deserves wider use is that of the savory herbs, such as sage, thyme and bay leaf. Parsley and celery leaves may well be included in this last.

Flavors which are flavors only and add nothing to nutrition may be harmful. Hence it is best to rely chiefly on real foods as a source of flavor. Highly-flavored foods are best eaten, too, in combination with those of less marked flavor; for if taken alone they may spoil the appetite for other things.

Among vegetables, onions are the most generally used to give flavor to other dishes. It is generally known that fried onions may be used to flavor soups and stews.

Another vegetable which deserves wider use for this purpose is the pimento, a mild red pepper. Green peppers are a splendid flavoring vegetable, whether used raw in salads, or cooked with meats and other vegetables.

Plain sugar, molasses, honey and fruits may also be considered as flavor foods. In desserts, such as pies, cakes and puddings, fruits are used as flavor foods, and by such use comparatively tasteless starches and fats may be made palatable. Raisins and currants are among the best foods for such use, and dates should be more used for this purpose.

The strongly-flavored animal-protein products, like cheese and cured meat, may be effectively used with vegetable dishes, and the serving of such dishes in place of meat is a great economy. A limited number of people can adopt cereals and milk, or other such mild-flavored dishes, as the backbone of their diet, and such persons will proclaim the discovery of a sure and simple way to beat the cost of living. Such a diet, however, is only economical to those who can live on it. But most people have been trained to meals built around a platter of meat, and to such appetites vegetarian enthusiasts address their arguments in vain. The meat-flavored vegetable dish, properly aided by good cooking, often meets the needs of such people. It is a practical meat substitute, giving them the well-fed feeling which, owing to their past habits, is inextricably associated for them with the meat flavor.

When more expensive food is used to flavor a less expensive one, it is highly desirable that we get the entire flavor out of it. The more finely such a flavor food is divided, and the more closely is it intermingled with the less tasty food, the smaller will be the proportion of the higher-priced food required. This is illustrated in the cooking of cheese with macaroni; the Italians use a hard, strongly-flavored cheese that may be grated fine, and with a single ounce of it they get a flavor equal to that derived from half a pound of the soft American cheese cut up in lumps.

In vegetarian cookery, celery, onions and mushrooms are most used

to give flavor to soups and stews. Grinding these foods very fine in a food-chopper decreases the quantity used from 50 to 80 per cent. without affecting the taste of the dishes.

Pure Foods and How to Know Them.—People like to know what they are buying, and they don't like to pay for one thing and get another. The pure food law does not guarantee a wholesome diet or nutritious foods. White flour, or cane sugar, may be pure, and yet not be satisfactory articles of diet. The pure food law does require that things shall be what they are said to be. The law renders a very important service. But that service should not be overestimated, and a knowledge of nutrition is still necessary. It is well that it should be so, for with a law that attempted to approve only perfect foods we would soon create a rigid standard of diet, leaving no chance for individual variation and no opportunity for improvement.

Milk purity is fairly well protected by state and city laws. Impure milk may be tainted, watered, or skimmed. Look for dirt in the bottom of the bottle. Watering and skimming can only be certainly detected with the aid of the lactometer, which measures the specific gravity, and the Babcock test, which measures the percentage of fat. If you suspect your milkman, and you have a local creamery under different ownership, the management of the latter will make these tests for you and explain them to you. Health departments should also make them free. They are simple, yet require an apparatus that is hardly worth getting for home use.

Pure milk should have a specific gravity of from 1.027 to 1.033. Its normal reaction is neutral or slightly acid. Sweet milk should never be strongly acid. If it is strongly alkaline, i.e. turning red litmus paper blue, it is pretty certain that something in the way of a preservative has been added.

When left standing for a few hours the cream should show a slightly yellowish color one-tenth or more of the whole amount. The milk below the cream should be lighter in color, with the slightest bluish tinge. If the color is yellowish throughout, the addition of a coloring matter must be suspected. Annatto, a vegetable color, is sometimes used to give a rich tint to milk. To detect it, add one teaspoonful of baking soda to one quart of milk and immerse in this mixture a strip of unglazed white paper. In an hour examine the paper. If annatto is present it will have become an orange color.

The most harmful preservative used in milk is formaldehyde. Put a little milk in a test-tube. Now slant the tube and carefully pour

down the side some strong commercial sulphuric acid. The acid will flow under the milk. Rotate the tube gently but do not mix the contents. Now hold the tube to the light. If formaldehyde is present a violet color will appear at the juncture of the two liquids.

Condensed milk should be sufficiently reduced to pour like fairly rich cream. As the law allows no thickening substances to be added, a comparison of several brands as to thickness will show you whether you are getting your money's worth. Take several such samples, measure the same quantity of each into glasses, add water a little at a time and stir until each sample has exactly the same indication of richness as judged by viscosity, color and taste. Now note the quantity of each. Sweetened and unsweetened milk must be compared separately. Sweetened condensed milk that has long stood on the grocery shelf will appear thick and lumpy at one end of the can. Do not confuse this faulty product with the virtue of a uniformly thick, rich cream.

Good butter has a fresh, sweet odor and an agreeable taste. It should be of the same color and consistency throughout, easily cut and adherent, and not crumbly when molded into shapes. Uncolored pure butter is a very light yellow when the cows are not on pasture. Nearly all butter is colored to meet the popular demand for yellow butter. Otherwise the colors would change with the cow feed, and we would be continually worried over the varied hues. Butter colors are generally harmless, but if you want to know whether your butter was colored by nature or by man, dissolve a little butter in a portion of warm alcohol. The natural color will dissolve, while foreign coloring will color the alcohol.

Butter should contain 85 per cent. of fat; the remainder is water, casein and salt. The most common adulterants are water, in excess, and oleomargarine. If an excess of water has been added, it may be shown by heating the butter in a test-tube or glass. Place the glass in a larger vessel of water and bring to a boil; in a few minutes the water in the butter will separate and collect at the bottom of the tube. The white floating masses are the casein and various milk constituents other than pure oil. It is largely these that give butter its flavor. Pour off some of the pure butter oil, cool it and use it as butter. You will then readily understand that pure butter does not mean pure butterfat.

The above test for water contained in butter will also help to distinguish butter from oleomargarine. Butter, when melted as above, shows cleaner separation of the water and a cleaner fat. The oleo, as

well as rancid and renovated butters, show a muddier, more opaque mass.

The following test is more decisive. Heat ten parts of sweet milk to near the boiling point. Add one to two parts of the suspected butter. Stir the melting butter with a freshly whittled wooden stick. Now dip the test-tube in cold water and continue stirring as the butter hardens. Pure butter will form a creamy emulsion with the milk and rise to the surface but slowly. Oleo will more quickly separate from the milk and form a mass of floating fat that will adhere to the stick.

Finely attuned noses can detect in oleomargarine a distinctive meaty smell like that of cooked meat, and the absence of the characteristic odor of pure butter.

Eggs in the shell are obviously not adulterated, preserved, colored, or misbranded. They may be very impure, however, owing to decomposition from bacteria and molds which find entrance through the pores of the shell which Nature kindly provided as a means of ventilation for the unborn chick.

Fortunately the egg, because of its delicate flavor and limpid color, advertises its decomposition much more quickly than do meats and cheese. The quality of eggs in the shell is tested by means of the egg-candle. The best egg-candle is a high-power electric light. Only inferior work can be done with a real candle, or smoky kerosene lamp. The egg of high quality is almost clear, with a slight darkening for

Eggs are a good source of protein. The white of the egg consists of protein and water exclusively.

the yolk. Only practice will enable one to tell that this dark yolk spot is altered.

Freshness is popularly considered the essence of egg quality. The actual factors of egg spoilage are heat, moisture and germ-bearing filth. In general these same principles apply to the spoilage of all food products. Carefully handled goods two months old may be much "fresher" in all true elements of quality than goods of the same sort only a few days old.

Broken-out eggs are packed and frozen in the centers of production in the summer time, and find their way into all sorts of bakers' goods and noodles throughout the following year. The bacterial count in these bulk eggs is very high. The flavor is noticeably inferior, and in cheap yellow cakes bought on the East Side of New York an experienced egg-man can often recognize the malodorous flavors of the egg-packing rooms of Omaha or Chicago.

In the case of the staff of life, the bleaching of white flour and the use of alum in bread are the most common kinds of chemical tampering.

There are no chemical tests for these practices that are simple enough for home use. Any fear of the bleached product may be sidestepped by the use of a whole-wheat flour, which no one wants to bleach. The use of alum in bakers' bread is much less common than was at one time. The human weakness for ultra-white flour, or excessively light bread, is responsible for these follies, and they can best be avoided by trading with a baker who caters to intelligent customers and whose products are of the substantial order. Avoid unnaturally white and fluffy breads.

As whole-wheat flour is merely the whole wheat ground, it should be the cheapest and easiest to get of all flour products. That it is not is due to the fact that the large millers have built enormous mills and installed elaborate machinery for the purpose of manufacturing the patent article, together with its various by-products. For them to encourage the adoption of whole-wheat products is to destroy the utility of their elaborate machinery and to open the milling industry to any man with a simple grist mill that may be purchased for a few dollars.

If you wish to understand the exact composition of various raw cereal products, you can get samples of whole grains at a feed store and, by hand-crushing them, secure specimens of known origin for comparison with the various purchased products.

Cereal starch is all right in its place, but there are some places where it doesn't belong. One of these is in infant foods. Starch is also objectionable in meat preparations, spices and other products where it is used as a filler and sold at from two to ten times its actual value. To test for starch, place an inch of the material in a large test-tube or other receptacle and dissolve in double the amount of water. Heat to the boiling point and add a few drops of iodine solution. A deep blue color shows the presence of starch.

Bad meats are very bad. They are to be looked out for chiefly from three sources—canned meats, sausages and cold-storage meats.

Canned meats may be inferior in quality and purity from the use of meat from inferior animals or of inferior parts of the carcass, from deterioration of the meat in the canning process, from the addition of adulterants, flavors of preservatives, and from spoilage of the meat due to inferior canning. Nothing short of expert knowledge in such matters can detect all these elements of inferiority, and even then it is a matter of judgment rather than of chemistry. Sensible folk will avoid the use of queer-named and complex-looking canned meats There are a few brands of canned flesh foods, such as salmon, sardines, shredded codfish and chipped dried beef in glasses, the quality of which is self-evident.

The surest proof of faith in mankind is an appetite for sausages. Sausages from a government-inspected plant are probably as safe eating as many other foods, but they are still not likely to seem especially attractive to those who wish to know exactly what they are eating.

The only test for detecting adulteration in sausages which is worth consideration would be the test for starch mentioned, the addition of cereal products to sausage meat being a bad economic bargain for the consumer, though probably a good physiologic one.

Cold-storage meats may be of excellent quality. Halves of beeves killed in the great packing houses are promptly run into a room ten degrees below zero where they are frozen through. Later they are shipped frozen in refrigerator cars, and shipped frozen in trucks, being thawed out only in the retail butcher stop. More spoilage takes place after they are thawed, in the retail shop and on the way to the consumers' table, than in the entire process of packing, storing and shipping, even though it occupy many months and cover thousands of miles. Meats held for short periods by small concerns are not frozen, and these may develop ptomaines.

Do not be afraid to ask your butcher for frozen fish, flesh, or fowl. He thinks that you are ignorant of trade conditions and suppose it practical for him to sell you fresh goods; therefore he thaws his frozen goods as not to disillusion you. It would be better if he were to sell it to you frozen hard, with instructions as to how to thaw it in your kitchen just before you proceed with its cooking.

Labels on cans containing meat products should state clearly the nature of the contents. The presence of preservatives can only be detected by chemical analysis. As these products are practically all put on the market by the large packing-houses and designed for interstate commerce, they are subject to Government inspection, and, therefore, if they bear the Government stamp, they may be considered pure.

Canned fruit and vegetables when fermenting produce gases that accumulate, causing the can to swell. Such goods, commonly known as "swells," should not be used as food. Sometimes the pressure is relieved by puncturing the can, which is again sealed with a second drop of solder. Two drops of solder on the end of the can may, therefore, be looked upon with suspicion.

It often happens that acids in fruits and vegetables will attack the tin of the can, thus mingling the tin salts with the contents. The salts of lead are quite poisonous, and even if the tin is pure there is no medicinal claim made for its salts. Action on the tin will be made known by deep pits in the surface, or by patches of very bright metal, since the tin will normally be darker in color from long contact with the contents of the can. It is better, therefore, to purchase acid-containing articles in glass.

On opening the can the odor should be clean and fresh. The slightest trace of a sour, musty, or disagreeable smell should cause rejection of the food. The appearance should be clean, with no mold. One would think from the hues and shades offered us in canned foods that the manufacturer assumed that the buyer had never seen the fresh article cooked. At least the effort seems to have been to give the cooked product the bright colors of the uncooked article. With peas, string beans and brussels sprouts the cooked product is a rather dingy green; all bright green canned goods should be suspected.

Likewise unnaturally brilliant reds are found in ketchup and in fruit products.

Here is a general test for aniline dyes that will catch most of the color schemes, whether found in canned goods, preserves, or candy.

Mix the food in a little water and boil two portions separately in test-tubes with bits of pure white woolen cloth. To one portion add a few drops of hydrochloric acid (to make an acid solution) and to the other a little ammonia (to make an alkaline solution). Any bright color that will not wash out of the cloth indicates coal-tar dye.

One can learn to detect large amounts of glucose by the taste. Glucose, though artificial, is now recognized as a wholesome food. But, of course, if we are to eat glucose in honey, maple syrup and other products, we should get it at glucose prices; and it is the cheapest form of sugar known, as it is made out of corn starch.

Here is a test for glucose in honey which may also be used for syrups. Dissolve some honey in an equal amount of water, and put a little of the mixture in a test-tube or glass. Add wood alcohol, which will appear as a clear liquid above the honey; now agitate slightly and note the effect on the liquids. Pure honey will give a slight milkiness, which will become a dense white as the percentage of glucose is increased. This experiment should be checked with test-tubes of honey-products known to be pure.

To judge the purity of the coloring of candy, place a piece in a glass of water and dissolve with frequent stirring. If the color dissolves readily, it is probably an aniline dye. If it settles, it may be a harmful metallic color. Any milk-white, gritty sediment may indicate terra alba (white earth), barytes, or some other illegal makeweight substance.

Cottonseed oil is by far the most frequent adulterant of olive oil. One will soon get to know it by its taste, for it seems to taste in the mouth and on the tongue longer than pure olive oil, leaving a greasy feeling for some time. Cottonseed oil alone is almost without flavor. For a chemical test of olive oil, fill a test-tube or small bottle one-quarter full of concentrated nitric acid, adding a second quarter of the oil. Cork and shake thoroughly. Permit the mixture to settle. The oil will now appear a greenish yellow color if pure, and a reddish-orange or brown if foreign oil be present. Caution: The pure oil on long standing may turn brownish.

Of course the intelligent housewife will assure herself that she receives from her butcher, or grocer, the quantity as well as the quality of food to which her expenditure entitles her. Therefore no kitchen can be considered complete without accurate scales and measuring devices.

Know, when possible, who produces the food as well as who sells

it. As to both manufacturers and dealers, the very large concerns must do a large volume of business, and are not likely to produce or sell the very best or the very worst of foods.

Remember that old-established and well-advertised brands, while not invariably the best, have proven themselves at least acceptable to a vast number of consumers. Advertising expenses may be made up by the economy of large operations. Foods advertised in magazines are obviously sold in interstate commerce, and hence are subject to Federal supervision. State laws vary widely, but even if the state law be better than the Federal, as it is in many cases, still the interstate commerce article is a better risk, for it must pass the gauntlet of both state and Federal authorities.

Sensible Food Economy.—Food prices vary widely with time and place, hence no book can give you specific instructions as to what particular foods are the most economical which would be of permanent value. We shall therefore confine this discussion to a few general hints, pointing out how food values are wasted by bad cooking and how money may be saved by better kitchen management.

We do not advocate extravagance with food, nor do we advocate stinginess. As long as there are hungry people in the world it seems a crime to waste food, even when it is cheap; but, on the other hand, it is folly to deny oneself wholesome and appetizing food in order to save money for some other purpose.

Food is wasted not only by wasteful methods of preparation, but also by the foolish habit of cooking more food than those who are to dine will eat.

A third waste of food money results from eating in excess of the real needs of the body. Occasionally some editor gets furiously wrought up because he hears that food speculators are dumping food in the river to keep up the price. But probably that same editor goes to a restaurant and orders enough food for three men, eats enough for two, and leaves the third man's portion as refuse.

Overeating doubles your grocer's bills and triples your doctor's bills. It also cuts down efficiency, and so in a threefold way raises the cost of living.

Meat is always an extravagant element of the diet, and always will be, for the reason that it takes many pounds of vegetable food to produce one pound of meat.

These statements do not apply to the production of milk and eggs, for two reasons: First, these two products are more efficiently pro-

duced than is meat, because they do not require the death of the animal to yield the food; secondly, milk and eggs are actually of much higher food value than meats and make a real contribution to efficient human nutrition, which meat does not.

The annual per capital consumption of meat has in recent years fallen. On the other hand the per capita consumption of milk has increased. The meat-packers are greatly worried over this situation, and maintain an institute to try to induce the people to eat more meat. Because the farmers are engaged in rearing meat-producing animals, the United States Department of Agriculture has been induced to fall in with this campaign, and is making efforts to discover reasons why people should eat more meat.

All this effort will be largely wasted, however, because the reasons back of the declining consumption of meat are fundamental. The general enlightenment of the public in the matters of food and health is exploding the old superstition that meat is the chief strengthening food.

We are all inclined to be cowardly in our attitude toward public opinion. The only way progress can be made is for those who have more than the average amount of intelligence and courage to start new habits. The old habits of wasteful, unhealthful eating came about through ignorance and the superabundance of foods in general and meat in particular. Modern science has shown these old habits to be wrong.

Buy the most healthful, most tasty food you can afford, and cook and serve it in just sufficient quantities to maintain those who eat at your table in the pink of condition—with not a pound of excess weight—and you will have solved the problem of food economy.

Labor-Saving Cooking.—Cooking is an art, and to many women and a few men it is an enjoyable one. Yet I doubt if one woman in a hundred would say that she likes to stay in the kitchen longer than her duty requires. To be considered a "good cook," and yet to spend as little time in the kitchen as possible, is the universal and justifiable ideal. To this end the following important factors will contribute:

A well-arranged kitchen.
Labor-saving equipment.
Simpler recipes.
Fewer items on the menu.
Fewer meals per day.

To these requisites may be added the more general items of intelligence, systematic planning, and the practice which makes perfect in any work.

Efficient Kitchen Arrangements.—You are fortunate indeed, if, after having had your attention called to this subject, you have an opportunity to plan your kitchen on strictly up-to-date efficiency lines. Such a kitchen need not be more expensive, even at modern high building costs, than an old-time kitchen, because it can be much smaller. The old-time kitchen was a spacious place, part kitchen, part living-room and part factory. In the modern city or suburban home, where the kitchen is used only as a place to prepare food in, there is no advantage in having it unduly large.

The main point is to have a stove, sink, work-table, shelves for supplies and hooks for utensils, all arranged so that the work can be done with the fewest steps possible. Even where a new kitchen cannot be built, great improvements in convenience may often be secured by rearranging the main articles of furniture, and perhaps building in a few shelves.

The main table must be kept clear of utensils and material not actually in use, and the only way to do this without excessive labor is to provide places for these things practically within your reach as you stand before the table at work. A surprising number of things can be kept in a small space, if shelves, hooks and drawers are put in especially for that purpose.

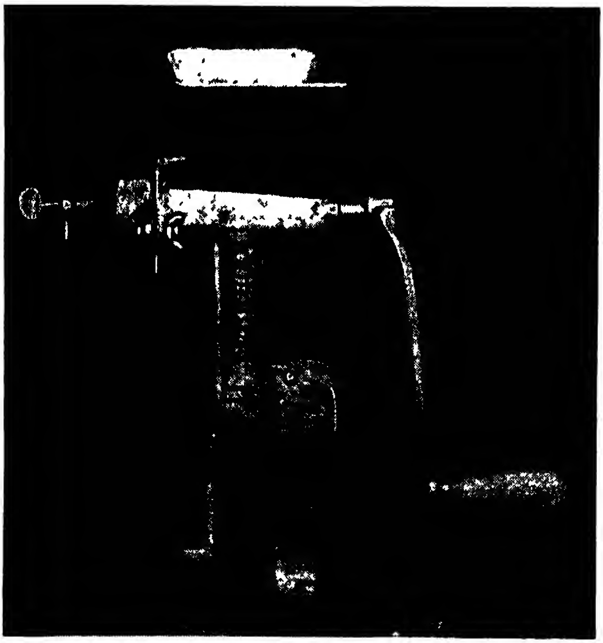
In planning the places for various materials and articles, make out a list and then number the articles in the order of the frequency with which they will be used; then arrange them like a typesetter's case, with the most used ones in the most convenient positions.

Efficiency engineers make time and motion studies of various work operations, and then try out methods that will take a fraction of a second off here and another off there. The total result often cuts the working time to half the original period. This plan is not applicable to cooking operations, because the same operations are not repeated often enough. But there is one operation that is repeated after every meal is served, and that is dish-washing. It will pay you to study out just how you do this and see how you could do it differently to save a few steps or a few seconds. If the distance from the dining table to the kitchen sink is very great, it will certainly pay you to carry the dishes in a large dish-pan, instead of in your hands. You should wash them without stepping out of your place

and, if you have hot running water to rinse them with, they can be dried in a shallow wire basket, without the use of a towel. Then comes an operation which is often needlessly laborious, and that is putting the dishes away in various cupboards, racks and drawers. If you really want to save labor, the dishes which are to go to the table for the next meal without food on them, may be placed in the basket and stay there until all are carried at once to set the table again. The dishes in which you are to take up food should be placed where they will be ready for that purpose.

Details of kitchen operations will vary with your kitchen, your cooking and your manner of serving meals. But if your attention is once drawn to the possibility of labor-saving by well arranged working facilities and well thought out methods of working, you will be able to go ahead and devise a system that may have surprising results in the way of time-saving.

A final suggestion is that you have a little kitchen clock and that you note down how long it takes you to perform some of these oft-repeated operations and then see how much you can shorten that time.



A small grinding mill of the type here shown is an excellent fixture in any home where the value of grains and other food products in their natural form is realized.

Labor-Saving Equipment.—There are many labor-saving devices you should like to have in your kitchen, and perhaps you cannot afford them all. Before investing in any of them, try to figure out how often you will use each of those under consideration and

how much time will be saved at each operation. These figures, when compared with the price, will show you which will be for you the better investment. Labor-saving devices that are used but rarely do not pay, and there is often a temptation to buy equipment that you will not use often enough to make the machine earn its board and keep.

Here are some random suggestions for labor-saving equipment; some of these you may have, others may not be available in your circumstances.

Running water, hot and cold. An ample sink with drain-boards.

Gas stove. Blue-flame kerosene stoves. In a few cases an electric stove.

Above all and in some form, good overhead lights.

A modern electric or gas refrigerator.

A zinc-covered work-table. Double boilers; a steamer; a fireless cooker; a steam-pressure cooker. Covered baking-dishes. An ample supply of porcelain, pyrex glass, or other suitable baking-dishes that can be placed on the dining-table without redishing the food. A good meat and vegetable chopper. A small mill for grinding dry material.

The smaller handy utensils are too numerous to mention, and vary from wooden mush-sticks to electrically driven egg-beaters. Some things that are bought at the ten-cent store will save ten dollars' worth of labor. Get what you need for the kind of cookery you do, and avoid especially the waste of your money on complicated contrivances for operations you will only perform in getting the Thanksgiving dinner.

Simpler Recipes Save Labor.—Not all simple foods are simply prepared. Good old-fashioned lye hominy is a simple food consisting of nothing but grains of corn, but preparing it is a laborious operation. But, as a rule, the fewer ingredients in a recipe the more quickly is it prepared.

Simpler cookery is, after all, the easiest way to economize on labor as well as on cash. Even if your family insists on complicated cookery most of the time, they will appreciate a mush-and-milk supper once in a while for a change.

By using your head more and your hands less, you can save labor. Have a greater number of simple dishes, and give your family a wider variety of simple foods from day to day, instead of repeating over and over a limited number of complicated dishes.

The cooking of meat and pastry is what makes most kitchen labor and this is partly because it makes more and harder dish-washing.

Vegetable cookery is more cleanly and less laborious. Uncooked salads are often a bit complicated, but at least they require no time for cooking and are especially suited for those occasions when you do not enter the kitchen until half an hour before the meal is served.

Use Simpler Menus.—Variety is desirable in the diet, but the variety need not be in a single meal. Have a few good things at each meal, and a few different good things at the next meal. Reduce your dish-washing to a routine, but not the planning of meals. Be on the lookout for new dishes made out of familiar foods to introduce into your bill of fare, and check in your cook book, or keep in a note-book, the ones that prove the best for your purpose. Planning your menus takes a little time, but it saves that time and more in their preparation.

Keep yourself stocked up with moderate quantities of the food materials you use regularly. A large cardboard ruled in both directions may be used as stock sheet. On the horizontal line can appear the name of the food materials which you keep in stock. Have this tacked up in a convenient place with a pencil tied to it. Then as you note any material is getting low, make a check in the first vertical column. Now plan your menus for two or three days ahead, and note down the special ingredients required for the recipes selected. Add to this list the items already checked on your stock list, and you will have a buying list. This list, by reducing the time expended in marketing, and preventing delays, or false starts in trying to make things without proper materials, will fully repay you for the trouble of making it. You will also secure more variety and better food with less work in cooking.

Number of Meals a Day.—People at hard physical labor require three meals a day. Two are enough for adults when they are not engaged in such labor. They are not enough for young growing children, who are, or should be, nearly as active, in proportion to their size, as farmers or mechanics. Even workmen and children can eat enough to nourish them adequately in two daily meals, but they require an amount of food that is usually more easily digested if divided into three meals.

In the household where there are only adults staying at home, or working in offices or at light mechanical labor, two meals a day is enough for health. If this plan be adopted, it cuts the kitchen work to only two periods a day, a very important item indeed in the matter of saving labor.

The meal omitted is a matter that must be settled by the convenience of those concerned. When the man of the house has lunch away from home it is most likely to be the noon meal—a plan which permits women to cut down their own meals to two, even when the men folks are engaged in heavy labor and require three meals.

When a member, or members, of the family work in offices, and from habit or because of business luncheon engagements, eat a heavy meal in the middle of the day, then it is the breakfast that should be omitted, or, if not omitted, it should be made very light.

The presence of children in the household makes the two-meal plan seem unpractical, unless the children have their lunches away from home, or are given an extra meal in which the parents do not join.

While Cooking One Meal Start the Next.—There are some dishes that require from one to five hours to cook. Many of these can be started while the preceding meal is cooking. Then the cooking can be interrupted, and resumed later, so that the total time you are in the kitchen is greatly reduced. Such devices as double boilers and fireless cookers are very helpful here. The cooking time of many materials can be greatly shortened by previous soaking, during the day or overnight. Or the materials can be brought to a boil and then set on the back of the stove, or in a double boiler to cook more slowly.

Such foresight and doubling up of operations will enable you to have a well-cooked meal ready in a few minutes after you enter the kitchen. I will have to leave it to your common sense and experience as to what foods are injured by such interrupted cooking, but the number of things—like beans and dry cereals, dry fruits, meats, etc.—that can be cooked in this fashion is much greater than that of foods—like bread and potatoes—in which the cooking operation cannot be interrupted.

Most desserts that are to be served cold, and especially gelatin desserts, should be prepared while you are in the kitchen and getting or clearing up after the preceding meal. Salads, on the contrary, should be freshly prepared.

Here is a typical evening meal and suggestions for preparing it:

A vegetable cream soup.
Baked potatoes and baked onions.
A salad.
A gelatin dessert.

While in the kitchen washing up the dishes of the noon meal, prepare the vegetables for the soup, put them on and bring them to a boil. Then make your gelatin dessert and put it in the ice-box. Wash the potatoes and onions, and put them in the oven. Then go out for the afternoon. On your way home buy a fresh head of lettuce for your salad. When you come into the house at a quarter after five, go immediately to the kitchen and light the oven. Then change your clothes. If you can manage to return to the kitchen at five-thirty, you can relight the fire under your vegetable soup, add the milk and thickening, and have supper ready to serve at six o'clock. The potato-onion combination is a delectable dish if the potato is cut up after baking with the skin on and the peeled onions well mixed with it. Add butter with salt to taste.

The same meal without the forethought would have required you to be in the kitchen at half past four, and even at that you would have had trouble getting the gelatin to harden in time to serve it. This particular example may not fit your way of doing things, but the principle is sound.

Breakfast can also be prepared for in advance. All cereals and fruits can be prepared the night before, and the meal need never require you to be in the kitchen longer than the time required to warm up the cereal, or cook eggs.

Cooking Processes.—Cooking processes may be roughly divided into the preliminary preparing and mixing processes and the cooking proper, which involves the application of varying degrees of heat and moisture.

Most foods that come to us in their natural state must be looked over and cleaned. This involves removing wilted or decayed portions and freeing from the insects and dirt that are natural results of growing conditions. Washing is usually a part of the process, and needless paring is often done when thorough washing would serve quite as well. The skins of some foods, like bananas and oranges, are obviously inedible, but there are many other foods the skins of which are quite edible and consequently their removal a waste of substance and labor.

Because skins are not digestible is no reason why they should not be eaten, for such skins are composed of the fiber, or cellulose, needed to secure the natural action of the intestines. The use of wheat bran for this purpose is well understood, but many have not realized that

the skins of vegetables and fruits are also "bran," and quite helpful in the diet.

Not only do the fibrous skin of seeds, roots and tubers thus serve a useful purpose when eaten, but, as a general law of plant life, the layer just beneath the skin usually contains more valuable food elements than does the interior portion, which is merely a reservoir of fuel food. Thus in potatoes, the "eyes," or germinal spots, are at the surface.

Further, the removal of the skin exposes the interior to the leaching out of the soluble salts and vitamins. This is very important when the foods are boiled and the water discarded, but does not apply when the liquid of the cooking process is used.

In no case should food be pared when the removal of a thin and harmless skin necessitates the removal of the food substance beneath. This particularly applies to potatoes. Potatoes, carrots and parsnips should be washed with a good stiff brush, and the skin either eaten or removed after cooking.

In many fruits important nutritives and the richest flavoring substance are in the skin. Orange and lemon rinds contain an aromatic oil, much used as flavoring. Orange peel, rather than orange juice, is the distinctive element in marmalade. Apples and pears and similar fruits are better flavored as well as more nutritive if cooked with the skins.

Chopping and Grinding.—The modern customs of preparing foods do too much of the chopping and grinding which our teeth were intended to do. No general rule, however, can be applied. In the case of nuts thorough grinding, as in peanut butter, is probably an advantage, since ordinary chewing does not divide the nut substance finely enough to make it readily digestible. Cereals are best when the grains are whole, or only coarsely ground, and when they are cooked until tender but not mushy. Boiled whole or cracked wheat, coarse corn hominy, whole rice, oat groats, or granular oatmeal, are all superior to the same materials finely ground, or, in the case of oats, rolled.

Vegetables should be cooked whole, or at least in fair-sized pieces, except when, as in making soups, it is desirable to cook the flavor out of them rather than retain it. Green vegetables and raw fruits for salads may be chopped fine enough to make them convenient to eat, but need not be minced or ground.

The cooking time is, of course, shortened by dividing the food into

smaller pieces, since the large pieces take considerable time to heat through. Most of the cooking time required for baking or boiling potatoes is merely a matter of the time required for the heat to penetrate them. You can save a lot of this time by using the medium-sized ones for whole cooking and the larger ones for soups, stews and French frying.

In the case of dried fruits, or dry grains or beans, much of the time required in cooking is consumed by the slow penetration of moisture, and this cooking time can be shortened by previous soaking.

Measuring Ingredients.—Weighing is the only accurate way to measure food materials. But it is hardly practical for every-day use. The cup is the universal recipe unit. A cupful means half a pint, and since cups vary you will do well to see that you use the half-pint size. A pint of liquid is sixteen ounces.

The convenient teaspoon and tablespoon are not accurate units of measurement, since the spoons vary and the degree to which they are filled varies still more. It takes about eight level teaspoons of liquid to make an ounce. The heaping teaspoon is, of course, pure guesswork. The ounce is a better form of measurement, but few people have ounce scales. Here are two ways to approximate it. When butter is wrapped in the small quarter-pound sticks, one can gauge an ounce very accurately by cutting such a piece into four equal parts. Another way to gauge an ounce is by comparison with a fair-sized egg, which weighs two ounces.

These standards can be used only with liquid or wet foods. In the case of powders, or loose foods filled with air spaces, the only way to judge weight with the eye or the measuring vessel is to get a known weight, divide it into equal portions, and measure these.

It is, of course, impossible in recipes to give the exact amounts to fit every family. Even if the size of the family is known, it is not possible to designate the amount of the dish to be prepared, for that will depend on what other dishes are to go with it.

To modify recipes to fit your needs is not difficult, especially when the ingredients are given in cupfuls. Simply estimate what portion of the recipe you wish to prepare, and fill a corresponding portion of the first cup. Shake it until the material stands level in the cup, and note how far from the top it comes; then fill the cup always to that same point.

Seasoning is usually given by the teaspoon or the fraction thereof, but that is only to give you an approximate idea of the amount

required. "Season to taste" is quite as sensible an instruction, for your notion of how much seasoning you should use naturally is tempered by conditions.

Mixing Ingredients.—Recipes usually tell you the order in which to mix the ingredients. Sometimes this is unimportant, the only essential point being to mix them thoroughly. In other cases the order is quite important. For example, adding baking-powder to liquid before the flour is stirred in permits the gas to escape, and the effect is lost. Mixing milk with acids or egg causes curdling that spoils such materials as tomato soup and lemon pie-filling. Mixing oil and acid in salad dressing must also be done in a certain way, if the ideal emulsions are to be obtained.

Frequently the effects of lightness or smoothness can be secured by thorough mixing, or beating of the ingredients. Lumpiness in batter, puddings, gravies and dressings can only be avoided by following the directions as to the order and conditions of mixing. Get a good egg-beater and use it, not only for eggs but for mixing many other ingredients. An ice-shaver and a tin shaker are needed in preparing many beverages.

Shaping and Garnishing.—Foods may look mussy and unattractive, or neat and simple, or fussed-up and fancy. You can have them any of these ways you like. Dressing up the dishes we serve is a good deal like dressing ourselves. We all want clothes to keep us warm, most of us want to look neat, and all of us want an occasional bit of ornamentation. Sometimes if our clothes aren't shaped right it may injure our health, but food in fancy forms is as wholesome as food in plainer guise, and more so if it brings good cheer to the table. In families with children at the toy-loving age any sort of ornamental trickery with foods is a great joy-giver.

Heat and Moisture in Cooking.—The different degrees of heat and moisture to which foods are subjected differentiate the various processes of cooking from one another. The extraction of moisture, as in dessicating or drying foods, and the adding of moisture in soaking foods, are not strictly cooking, but both these processes materially change conditions and flavors. Dried fruit has a somewhat different taste from fresh fruit, and dry fruit may be freshened by soaking overnight, in which case you will have a palatable article somewhat different from either the fresh fruit, or the dried fruit cooked.

The greater the degree of heat, the more rapidly will the moisture be driven from the food material or absorbed by it, as the case may

be. To this fact is due most of the differences in the time required for cooking by different processes.

Dry heat is applied in toasting, roasting and baking. In toasting and broiling the food is exposed to radiating heat which quickly cooks the outer layers. The method is suitable only for foods cut so thin that they can be quickly cooked through, or else for those which do not require to be cooked through, either because they have been cooked before, or because we prefer, as in the case of steak, to eat them partially uncooked. Steak may be pan-broiled by first rubbing the skillet with a little suet and then by turning the steak frequently. Such steak is more wholesome and better flavored than steak fried in a large amount of fat.

Baking exposes the object on all sides to dry heat at temperature considerably higher than the boiling point of water. This crusts or browns the outside, but the moist interior is not raised above the boiling point. Only occasionally are foods like zwieback and crackers so completely baked that they are entirely dry and equally cooked throughout.

Cooking "En Casserole."—A method of cookery now finding much wider use than formerly is really a compromise between baking and steaming or boiling. This is cooking in the oven in a casserole, or other covered dish, with various amounts of liquid added, according to the effect desired. In this case the foods do not crust over so quickly, and there is less danger of their burning on the outside, while there is also less danger of their cooking down and burning on the bottom of the cooking vessel than in cooking on the top of the stove. Yet the foods are not water-soaked, as when steamed or boiled—are just as tasty and certainly are more nutritious.

The great majority of foods and many food combinations may be cooked in this fashion. Any degree of browning over on the top may be secured by removing the cover of the dish at a suitable time. In this style of cooking nothing is wasted, as all the juices are retained in the dish as served.

Paper-Bag Cookery.—Paper-bag cookery, which has attracted considerable attention, is very similar in effect to cooking in the oven in a covered dish. By enclosing the food in special parchment paper, the direct radiation from the overheated oven walls is shut off, and yet there is an even heat all around the food. The result is that there is less scorching and burning on the outside and more even cooking throughout. Another advantage is that the food is shut up in a

In using parchment paper especially treated for cooking, the paper is first dampened, then the food is enclosed within it and cooked by various methods, including steaming or baking.

This photograph illustrates the manner in which food may be completely enclosed in specially prepared parchment paper before cooking. Food thus enclosed may be cooked by steaming, boiling, or baking. The wrapping in parchment retains flavors that otherwise would pass off as vapor or be dissolved in water.

small air-tight container, and its vapors are prevented from escaping; hence the claim of the greater retention of flavors.

Waterless Cookery.—Another method of cooking that has a distinct advantage is the cooking of moist foods in their own juices, without the addition of any, or, at least, of very little water. In the case of very moist green vegetables this can be done in an ordinary pot on top of the stove, if the fire is turned low and a little water is on the greens from recent washing. But it is much more easily done in a tightly covered double boiler, since there is then no danger of the food burning or sticking on the bottom of the pot.

Thick aluminum vessels, sometimes called waterless cookers, are helpful in attaining this type of cooking The thick aluminum conducts heat so rapidly that the bottom of the vessel is not so hot and the sides and top are hotter Hence there is less burning and more even cooking It amounts to a small oven on top of the stove Indeed a cast iron vessel of this type is called a Dutch oven

Vegetables cooked in this way better retain their ingredients and flavors, and are not water soaked and washed out as when boiled For the thin, leafy, or tender vegetable, this method of cookery has

Using prepared parchment paper in the cooking of fish.

the same advantage that oven cooking has for more solid materials. Obviously one cannot bake thin leafy material, as it would simply dry out. Therefore the usual method has been to cook such substances in water, which is all right if one wishes stew, but when the elements and the flavor are desired in the original substance and not in the liquor, cooking in water is a failure. Waterless cooking solves the problem.

The Double Boiler.—The double boiler can be used for the cooking of almost any materials that are cooked in water. The process will be slower than boiling, as the temperature maintained in the top vessel is from ten to twenty degrees less than the boiling temperature. If the food is first brought to a boil on the open fire, the cooking will be much expedited, as the material heats very slowly when it is put into a double boiler cold. Put the food in one pot and the water in another and bring both to a boil; then place the one pot in the other, and turn the fire so it will keep the water boiling gently. You can then turn your attention to other matters.

The Steamer.—The effect of the steamer is not very different from that of the double boiler, as in both cases the temperatures are somewhat lower than the boiling point. In the steamer foods tend to absorb more moisture from the steam, while in the double boiler they tend to dry out slowly. This applies to food not immersed in water. If the foods are immersed in water and then placed in the steamer or double boiler, the effect will be the same, the only difference being in the way the heat is transferred to the vessel that contains them.

The Fireless Cooker.—The effect of cooking in this rather wonderful and economical device is very similar to that of the processes just discussed, as cooking goes on at a point somewhat less than boiling temperature.

The fireless cooker is merely a device for insulating a pot of food so as to keep it near the boiling temperature to which it has been brought on the stove. If an ordinary cooking pot has a good lid on it and is clean, it may be wrapped, first in newspaper, or an old towel, and then in a blanket or any heavy cloth. This gives you a rather clumsy, but very effective fireless cooker.

A handy person can make a fireless cooker that will be somewhat more convenient. The only purchased article required is a covered pail, large enough to hold the cooking pot to be used and made of any bright metal. A box is required large enough to give three or four inches all around the pail, sides and top and bottom. A horizontal

partition is fitted in this box with a hole cut the size of the pail, and this partition is set down about three inches from the top of the box. The space beneath and around the pail is stuffed with any insulating material. Either cotton or crumpled newspapers will serve very well. After the lid of the pail has been put on, a pillow made of cotton fills the remaining space, and a lid it fitted on top of the box to hold the pillow in place. A pot of food placed in this device when boiling hot will continue to cook for several hours, and will keep warm for a half a day.

The Steam-Pressure Cooker.—Water boils at 212 degrees and cannot be made any hotter while exposed to the atmospheric pressure. This is one of the facts that women do not seem to understand, for if they are in a hurry to cook anything they will boil it "hard." Once a pot is brought to a boiling temperature, cooking proceeds just as fast, as long as it is kept boiling, whether it boils fast or slowly. Where fuel is an item there is considerable economy in turning the flame down to the minimum amount that will just keep the pot boiling.

But water and steam will get hotter than the boiling point if under pressure. Hence the steam-pressure cooker now on the market will cook more quickly than will ordinary boiling or any other method. The pressure cooker is a rather expensive device, as it must be both light and strong. But it is an excellent cooker. It has another very important use, especially on a farm, and that is in sterilizing foods for canning.

Quick Cooking Desirable.—Some of the cooking utensils just described are labor saving rather than time saving devices. Prolonged slow cooking is better suited to grains, dry peas and beans and to tough meats. But for tender meats and all moist fresh fruits and vegetables the present tendency is for quicker cooking. This is not attained by special vessels or more heat but merely by less cooking.

Both the scientific knowledge of vitamin destruction by long cooking, and the desire of women to cut down their time in the kitchen have combined to bring about this change. Any other health argument for it is that things are not cooked to pieces but retain more firmness to stimulate chewing. The distinction in the old and new vogue is seen in tables of time for cooking various vegetables. Thus for string beans the old cooking time was given as high as two hours, while now sometimes as little as fifteen minutes.

A safe rule is to cook all fresh fruits and vegetables for as short a time as you find will make them palatable. It is even worth while

using a little will power to change your tastes in some cases. Thus the old style of boiling cabbage for an hour or more is now replaced with cooking fine cut cabbage for ten minutes. And many for whom the long cooked cabbage gave digestive trouble find that the quick cooked cabbage is more wholesome.

Making Whole-Wheat Bread.—The extensive use of grains as food, except in rice-eating regions, depended upon the invention of the arts of grinding grain and making bread.

Long before men built pyramids and made themselves walled cities, women sat grinding at the mill, pounding grain into flour and patting it into bread and cakes. For tens of thousands of years men thrived upon bread made from grains ground whole. Only within the last century has the invention of elaborate milling machinery eliminated the hulls of wheat and made the fine white flour which has become the staff of life of western civilization. This white, "patent," or fine flour, has been accepted because it makes a whiter and lighter bread than the dark heavy loaf of the peasant and backwoodsman.

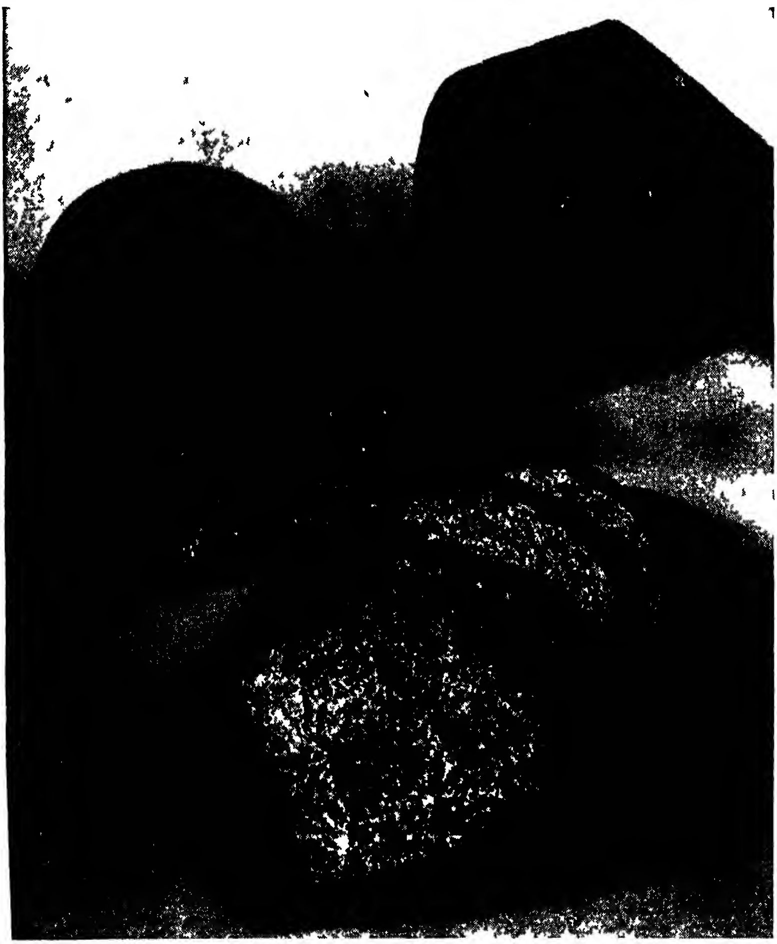
Thus white bread became the emblem of civilization and prosperity. Not to have white bread to eat was a sign of poverty and unprogressiveness. But, as in the case of firearms and fire water, it was progress of doubtful value. Above eighty years ago a man named Sylvester Graham found fault with white flour. Graham's argument was based upon health, and he claimed that the part of the grain we discarded contained the best elements of the wheat. His views, after generations of opposition, have now received the endorsement of science—an endorsement due to a larger understanding of the rôle of mineral elements in nutrition and the discovery of vitamins.

Graham, or whole-wheat, bread is not as completely digestible as white bread, but completeness of digestion is not a test of the wholesomeness of a food. Crackers, cheese, sugar, starch and oil are all completely digestible, and for that very reason a diet of such foods, if long continued, would send a man to nonmaterial realms where digestion of any sort would be quite superfluous.

The very fact of the less complete digestibility of the whole-wheat bread is one reason for its wholesomeness. That portion which is indigestible consists of pure cellulose, but even the bran is not pure cellulose, for it contains food elements that are dissolved out by the digestive juices. These include the highly essential mineral salts and vitamin B.

The foods of civilization, including meat, milk, cheese, eggs, fats and

sugars, are almost completely devoid of any digestive residue to give the necessary bulk for intestinal action With a diet of such concentrated foods, the addition of whole-wheat bread is invariably beneficial. The proper amount of the branny elements of wheat that should be used is determined by the nature of the rest of the diet If the diet contains a large amount of fruits and vegetables, less of the whole wheat is required. In some cases not only whole wheat but added bran is desirable.



This photograph of whole-wheat bread, in the loaf and also in slices, indicates the dark color and porous texture of this form of bread.

Genuine whole-wheat flour can now be purchased in practically all markets On farms where there are mills for grinding grain for animals, whole-wheat flour may be made at home with little expense. If such flour is a little too coarse for bread-making, it may be mixed with white flour, provided the diet is not otherwise deficient.

Hand-mills may be purchased for home grinding. The ordinary coffee-mill is too slow to be practical, but a larger hand-mill will be well worth while, especially if you adopt the habit of using cracked wheat as a cereal. The same mill may be used for cracking corn and making

The bread shown in the lower part of this photograph is the form of rye bread in general use in America. It usually contains some wheat flour. The bread in the upper part of photograph is pumpernickel, which, as generally sold, contains no whole-wheat flour.

coarse cornmeal. Such mills may be had from all large mail order houses.

One of the most valuable elements in whole-wheat flour is the water-soluble vitamin. This is present in the bran, and still more abundant in the germ. Such wheat germ is now being put on the market and may be used to enrich bread or other cereals with this important vitamin.

For those who do not tolerate the bran fiber the minerals and vitamin may be extracted by soaking bran in water. The use of bran water in cookery enables one to make white, or nearly white bread, which has some of the nutritive qualities of the genuine whole-wheat bread. However, this has no advantage over the whole-wheat product, except for those who have found that a high percentage of the coarse bran is irritating to the digestive tract.

The amount of coarse fiber, or cellulose, to be eaten is not the same for all, because the effect will vary with the individual. Most people on a conventional diet eat entirely too little of this coarse fiber, and will hence be benefited by the use of genuine whole-wheat products. Those who have found that whole wheat furnishes too much fiber for their particular digestive processes may use wheat germ and bran-water breads with advantage.

Bread-making is an art that cannot be wholly reduced to definite rules that will apply in all cases. Even if the flour used is genuine whole wheat, this does not mean that it is always the same because there are different varieties of wheat, carrying different proportions of gluten. Moreover the yeasts may vary, and it has been definitely shown by commercial bakers that the action of the yeast depends not only on the temperature, and the nature of the flour or other ingredients on which it feeds, but also upon the water used in mixing the bread—or rather upon the mineral salts that are present in or absent from the water.

Many women, who have through experience learned to make good bread from white flour, try to make whole-wheat bread in exactly the same way, and fail to get satisfactory results. They will have to relearn the art of bread-making, for whole-wheat flour requires another procedure.

Considering these difficulties, we will give you here two sets of instructions, as reported by two persons, both of whom made a success of whole-wheat bread-making. One of these is a housewife and one a baker for health restaurants. It is not so much that these are different

breads, but the method varies slightly and is described in different ways. Read them all over carefully, and then pick one and try to follow it. At the same time use your own judgment and experience to adapt it to your own materials and ways of bread-making. In order not to diverge from these carefully worked-out recipes, we are giving the amount of salt as these people use it, but the salt has nothing to do with bread quality and may be omitted.

Baker's Bread Recipe.—Three pounds of flour, one-half ounce sugar, three-quarter ounce salt, one-half ounce any good vegetable fat, one-half ounce yeast, one quart water (warm in winter, cold in summer).

Mix together the flour, fat, salt, sugar and water. Add the yeast, having soaked it previously for fifteen minutes in a little warm water, taken preferably from the quart you allow for the making of the bread. See that the yeast is thoroughly dissolved, and that none remains in the bottom of the cup when you put it into the batter.

Having added the yeast, mix the whole combination thoroughly, and see to it that no lumps of flour are left. Don't prolong the mixing unnecessarily, as too much of it does more harm than good.

The dough, when this mixing is complete, should not be soft enough

Here is shown the European or "sour" type of rye bread. Rye flour contains less protein than wheat flour and makes a dry, somewhat tough, yet palatable bread.

to run. If it is, add enough flour to stiffen it to a point where it will not run. This depends largely on the kind of flour you use.

Let this mixture rise for about three hours in a temperature ranging between seventy-five and eighty degrees. The dough ought to rise to twice its original size. The best way to find out whether it has risen properly is to thrust your finger into the middle of it. If it falls when you do that, it has risen enough. If it does not fall, it has not risen sufficiently, and you must let it stand a bit longer. Don't let the dough stand till it falls of its own accord, without the help of your finger, for that means that it is too "ripe."

When the finger test shows that the dough is ripe, punch it down to its original size, and then let it stand for another half hour, or until it is ripe again. Use the finger test, as before, to determine this.

When it is ripe a second time punch it down again, and immediately mold it into loaves, dividing the lot into three.

One good way to tell whether the dough has risen sufficiently in the pans is to feel it with the hand. When it has risen properly it will be soft, as compared to its condition before rising, and will have a certain silky feel to it, which you will have to learn by experience to recognize. When the dough acquires that significant softness in the pan, it is ready for the oven, regardless of whether it has risen to the height you desire or not. It will rise a little more after it gets into the oven.

The temperature of the oven should be from 350 to 450 degrees Fahrenheit. If you haven't a thermometer, you can interpret this to mean a moderate oven, not an extremely hot one. Bake the bread for an hour, more or less, according to the oven temperature.

Housewife's Bread Recipe.—Thirteen and one-third cups whole-wheat flour, five cups lukewarm water, one and one-quarter cups milk, one level tablespoonful butter, two level tablespoons salt, three level tablespoons sugar, one cake yeast.

Put the yeast in a cup of lukewarm water before you do anything else, and set it aside to dissolve. Next mix the salt, sugar, butter and milk with four cups of lukewarm water, being sure to have the water warm enough so that the completed mixture will be lukewarm.

To this combination add the dissolved yeast. Be sure that the whole thing is lukewarm. Insufficient warmth will ruin the result.

Now add the flour, and turn in a bread-mixer for seven minutes. A mixer is a great convenience, as this dough is very thin and sticky.

Cover the top of the mixer, and let it stand in a warm place for from four to six hours. If the dough takes six hours to rise, it has had

insufficient heat either in the mixing or during the rising period, and the bread will probably not turn out as well as it should. The ideal rising period is a trifle over four hours. The dough should rise till it is almost twice as high in the mixer as at first.

Divide the dough into three parts, put it in buttered bread-pans, and set aside in a warm place till it rises to the top of the pans. Before rising in the pans the dough will fill them a little more than half full, if they be full-sized pans. The rising should take eighteen to twenty minutes, and a good way to get enough warmth to cause this rapid rise is to light your oven and place the dough near it.

When you put your bread in the oven, be sure that the latter is very hot. After the bread has been in this heat for five minutes, turn the burners lower, to the point which will give what you ordinarily consider a "moderate oven." Bake for fifty-five or sixty minutes, changing the location of the pans in the oven occasionally, so that all sides will bake evenly. On removing from the oven butter the tops of the loaves, and let them stand to cool. As a result of this method of baking the loaves will have a thick, firm crust, and the bread itself will be light. Don't cut the bread till the next day, and when you do use a very sharp knife.

Use of Milk in Bread-Making.—The use of milk adds greatly to the nutritive properties of any bread. Milk should be used in all breads, unless the whole family drinks milk regularly. When whole milk is abundant and inexpensive, it may be used for the liquid of the bread instead of water. When it is more expensive per quart than the evaporated is per can, the latter may be used with economy. By the use of evaporated or dry milk the percentage of milk in the bread can be increased to a greater degree than would be secured from fresh milk. As there is considerable sugar in milk, no other sugar should be added to the bread when such high proportions of milk solids are used, unless you want a perceptibly sweetened bread.

Do not attempt to go to extremes in using milk nutrients in bread, or its texture and lightness will be destroyed and you will have a soggy loaf. About equal parts by weight of evaporated canned milk and flour, or about one-fifth by weight of dry powdered milk to the flour, is the safe maximum. These proportions will give breads about three times as rich in milk elements as whole-milk bread, in which fresh milk replaces the water. These higher proportions of milk are great enough to obviate the necessity of using other milk in a diet largely composed of such bread. Ordinarily we should advise using milk as a

beverage, and in other cookery, and not attempting to exceed the milk content of whole-milk bread—that is bread all the liquid of which is whole fresh milk.

SELECTED HEALTH RECIPES

HEALTH BREADS

Boston Brown Bread.—One cup entire-wheat flour, one cup rye flour, one cup yellow cornmeal, 1 teaspoon salt, two teaspoons soda, two-thirds cup molasses, one pint thick sour milk, raisins. Sift dry ingredients through a coarse sieve. Add molasses and sour milk. Beat well, turn into buttered mold, filling only two-thirds full. Add a few raisins while filling mold. Cover and steam for three hours in coffee tins.

Bran Bread.—Two cups white flour, two cups bran, one teaspoon vegetable fat, one-half cup molasses, two cups sour milk, two teaspoons soda. Mix all the dry ingredients thoroughly. Then add the molasses, sour milk and melted fat. Beat until well mixed. Turn into buttered baking-pan, and bake in a moderate oven one hour.

Bran Muffins.—One cup bran, one cup entire-wheat flour, three tablespoons molasses, one level tablespoon baking powder, one cup sweet milk. Mix, and bake twenty or twenty-five minutes.

Corn Gems.—One egg, one and one-half cups milk, two tablespoons brown sugar, one-half cup flour, one cup corn meal, two level teaspoons baking powder. Beat first three ingredients together. Then mix corn meal and flour and add a little at a time, beating well for at least five minutes. Then add the stiffly beaten white of egg, and bake in gem pans in moderate oven.

Oatmeal Bread.—One cup of rolled oats soaked in two cups of boiling water. One-half cup molasses, one teaspoon salt, one tablespoon butter. When blood-warm, add one-half yeast cake, dissolved in warm water, and then four and one-half cups whole-wheat flour. Mix with knife, and allow to remain all night. In morning cut down with knife and allow to rise again before putting in buttered tins. Cut down and pour into pans, raising once more before baking. Bake forty-five minutes. This quantity makes two loaves. A pinch of baking soda often helps to insure a good sweet bread.

Rice Muffins.—One cup boiled rice, one cup sweet milk, two eggs, two tablespoons melted butter, one teaspoon sugar, two of baking

powder, and enough flour to make a batter; beat hard and add the baking powder the last thing. Bake in muffin pan.

Whole-Wheat Biscuit.—Two cups whole-wheat flour, four teaspoons baking powder, one-half teaspoon salt, one-half cup shortening. Blend well and add one cup milk. Drop biscuits from tip of spoon onto floured baking sheet and cook from thirty to forty minutes in hot oven, 400, reducing to 375 later.

Whole-Wheat Gems.—One quart whole-wheat flour, one quart water, one tablespoon melted shortening, two tablespoons sugar, two tablespoons baking powder, pinch of salt. Beat thoroughly and put into hot, greased gem pans. Bake thirty minutes in hot oven.

Whole-Wheat Waffles.—Three cups whole-wheat flour, two eggs, one teaspoon melted butter, two cups milk, three level teaspoons baking powder. First, mix the flour and baking powder and work in the butter. Second, add the milk. Third, add the eggs, well beaten. Fourth, mix thoroughly and bake on a hot waffle-iron. May also be used for pancakes.

CEREAL DISHES

Baked Rolled Oats.—Steep rolled oats in sufficient sweet milk to cover it; season with salt and nutmeg to taste; put the mixture in a cool place or in an ice-chest for about one and a half hours, to prevent the milk from curdling and to allow the oats to absorb the milk. Butter a bread pan, pour the mixture into it, put small lumps of butter over the top of it, and bake in an oven of medium temperature for from forty to fifty minutes. Cut it in slices and serve hot on warm plates.

Boiled Whole Wheat.—Put a quantity of the whole grain wheat in a vessel and soak it over night in warm water. In the morning salt to taste and pour in double boiler and cook for from two to four hours. This wheat may be eaten with milk, cream or honey. An especially rich dish can be made by using milk instead of water to soak the wheat. Unless the milk is very fresh and the weather cool it would be well to sterilize the milk and wheat by bringing it to a boil the night before, to prevent souring. While boiling milk impairs its vitamin properties the procedure is permissible in this case as the milk will be later subject to long cooking heat anyhow.

Rice with Dates.—Wash one-half cup rice. Cook in large quantity of salted water until nearly tender. Drain thoroughly and put into double boiler with one-half cup pitted dates. Finish cooking until tender. Serve with cream.

Uncooked Oats.—For each person served, allow half a cup of rolled oats. Allow them to soak an hour or more, in just milk enough to cover them and a quantity of honey to make them sufficiently sweet. Stir well together and place in a cereal bowl. Sprinkle with raisins and with nut-meats of any sort, if this addition is desirable. Serve with cream.

EGGS

Boiled Eggs.—The proper way to cook eggs, especially for invalids or persons of weak digestion, is to keep them in water at 160 degrees to 170 degrees F., rather than at 212 degrees, or boiling, since the white, or albumen, of the egg is rendered much less soluble by this high temperature. A simple way of cooking them properly is to let the water boil, then set it back off the stove and drop in the eggs, leaving them for four to six minutes. Serve with fruit, toast and chocolate and you will have a perfect breakfast. One can also put the eggs in a vessel and pour the hot water on them. If left in long enough they will become hard-boiled, but tender.

Eggs Poached in Milk.—This is a delightful food combination and a superior way of cooking eggs. Heat the milk in a saucepan quickly until it comes just to the boiling point, then turn down the fire, or place an asbestos mat under the pan to keep the milk hot without burning. Break the eggs into a cup one at a time, and pour carefully into the milk. Cook until they are done enough to suit your taste. Butter may be added, or you may serve on buttered toast. Use only the best eggs.

Poached Eggs.—Have a pan of salted water boiling. Drop in the eggs carefully and set where they will keep hot but not boil, until the white sets. Serve on toast. It is a good plan to set muffin rings in this pan and drop an egg in each.

Scrambled Eggs.—Beat six eggs slightly and salt. Put a piece of butter in the frying pan, and when hot, pour in the eggs. Stir constantly until done. To make this dish light and juicy beat two tablespoons of milk with each egg.

Scrambled Eggs with Cheese.—One-quarter pound grated cheese, one-half cup milk, six eggs. Stir the ingredients together, but do not beat the eggs. Place in a buttered skillet, and cook over a slow fire, stirring constantly, so that the cheese is melted by the time the eggs are cooked.

VEGETABLES

Baked Onions.—Peel the onions and boil twenty minutes; drain, put in baking dish, cover with fresh boiling water and bake from one-half to one hour. Take up and pour over them a sauce made of the water they were baked in, which should be about one cup; if there is not enough to fill a cup, add milk, let boil and add the yolk of one egg beaten and the hot milk poured on it, then return to the fire until it thickens.

Baked Potatoes on Half Shell.—Bake potatoes, and when done cut in two lengthwise halves, with sharp knife. Scrape out contents into hot bowl, and then mash. To every six potatoes, add two table-spoons butter, three tablespoons hot milk, and one-half teaspoon salt. Mix thoroughly, beating with fork or Dover egg beater. Then add beaten whites of two eggs. Do not stir, but *beat*. Refill skins very lightly, heaping high on top and keeping the surface ragged. Put these skins upon shallow pan, and place in oven until well browned. Garnish with parsley, and serve hot on hot platter.

Baked Squash.—Add to squash cut into small cubes one table-spoon melted butter, two raw eggs. and three tablespoons milk. Pepper and salt to taste. Put in buttered bake dish, sift dry crumbs over the top, and bake in a quick oven.

Beets.—Do not break the skins in washing or they will lose their color in cooking. Boil one hour. Rub off the skins, split in halves, dish, and pour on them a boiling mixture of one tablespoon of melted butter and salt. Serve very hot.

Buttered Parsnips.—Boil tender and scrape; slice lengthwise. Put three tablespoons butter in a saucepan, salt and a little chopped parsley. When heated put in the parsnips. Shake and turn until mixture boils, then lay the parsnips in order upon a dish, and pour the butter over them and serve.

Cabbage with Cheese.—Two pounds cabbage, one cup milk, two tablespoons flour, two tablespoons cooking fat, one cup grated cheese. Wash the cabbage, cut into eighths, and cook till tender. Then place in a baking-dish. Make a white sauce of the flour, fat and milk, add seasoning, and on removing from fire the cheese. As soon as the cheese has melted, pour this sauce over the cabbage, and bake forty minutes.

Creamed Potatoes.—Five large cooked potatoes, one cup milk, two tablespoons butter, two tablespoons flour, small quantity of parsley,

salt to taste. Cube potatoes. Pour over them hot white sauce, which has been made from the milk, butter, and flour, as given above. Add minced parsley and salt to taste. Cook a few minutes and serve.

Creamed Turnips.—Cut peeled turnips into half-inch dice, boil in a very small quantity of water. When cooked, pour over a cream sauce made of one cup hot milk poured gradually over one tablespoon each butter and flour rubbed together. Season and serve. All vegetables made in this style should never be allowed to get cold before cream or sauce is added. When allowed to become cold they are not as easily digested and do not absorb the cream or sauce.

Egg Plant au Gratin.—One eggplant, three tomatoes, one cup bread crumbs, one tablespoon grated cheese, one teaspoon sugar, one tablespoon butter. Cut the eggplant in thick slices, and let them lie in cold salt water until ready for use. Then boil until tender. Place in a well-buttered baking-dish, and on top of each lay a thick slice of tomato, sprinkling over them a layer of fine bread crumbs. Put a teaspoon of sugar, a little grated cheese and a lump of butter on top of each. Bake in a moderate oven.

Fresh Creamed Corn.—Nine ears corn, one-half cup cream or milk, one tablespoon butter. Husk and remove the silk from the corn. Slit each row of grains, and with a dull knife scrape out all the pulp. Put this in the double boiler, add the cream and butter, and cook over boiling water for thirty minutes, stirring occasionally.

Mashed Carrots.—Scrape, boil and mash the carrots and beat in one tablespoon butter, salt and two tablespoons cream.

Mixed Vegetables en Casserole.—One pound potatoes, one-half pound carrots, one-half pound turnips, one quart water, one-quarter pound onions, four tablespoons cooking fat, one-quarter cup pearled barley, one small can tomatoes. Peel the vegetables, and cut into small cubes, or into tiny balls with vegetable scoop. Slice the onions into a casserole; add the cubed vegetables and the fat, and season with pepper and salt. Wash the barley, add to the vegetables, and pour water over all. Cover and cook in a slow oven for three hours. Any favorite combination of vegetables can be cooked in this fashion.

Peas au Gratin.—Soak one pint dried peas or split peas in cold water over night. Simmer five hours with half an onion and a little celery. Drain, put through a colander and add one cup bread crumbs, one and one-half tablespoons butter, salt to taste, one cup of milk, and put in a baking-dish. Grate a little cheese on top of peas, and bake one hour.

Scalloped Cauliflower.—Soak the cauliflower in cold water for an hour. Steam for thirty minutes, break apart the little florets, and arrange them in a baking-dish; pour over them a cup of white sauce, and sprinkle grated cheese over the top. Brown in a moderately hot oven.

Scalloped Tomatoes.—Take six large ripe tomatoes, skin and cut into small pieces. Spread a layer in the bottom of bake-dish, season well, put a layer of coarse bread crumbs over the tomatoes with bits of butter. Continue this until the dish is full, having bread crumbs on top. Bake one hour.

Spinach Soufflé.—Two pounds spinach, two eggs, two tablespoons butter. Cook the spinach until tender in a double boiler. Then chop, press through a sieve, and season with butter. Add the beaten yolks of the eggs, and then fold in the whites, beaten very stiff. Put into a buttered baking-dish, cover with bread crumbs, dot with butter, and bake until set.

Stuffed Peppers.—Mix two cups of sifted tomatoes with two-thirds cup of bread crumbs. Season with salt, minced onion, and minced parsley. Stuff the peppers and place in pan with a little water and butter at the bottom, to avoid dryness. Bake until tender in medium oven.

Sweet Potatoes and Apples Baked.—One pound sweet potatoes, one pound apples, one tablespoon sugar, two tablespoons cooking fat, one-half teaspoon salt, one-half teaspoon nutmeg or cinnamon. Boil the potatoes until tender. Peel and cut into slices half an inch thick. Peel and slice the apples, and arrange all in a baking-dish in alternate layers. Mix the salt, nutmeg, sugar and fat with one cupful of hot water, and pour over the potatoes and apples. Bake in slow oven from three-quarters to one hour. Prunes may be used instead of apples, but they must be cooked first.

Vegetable Roast.—One-half pound ground peas, one-half pound ground beans, one cup whole-wheat bread crumbs, carrots, celery, onions, two eggs. Make a vegetable stew of chopped carrots, celery, and onions; then stir in the peas and beans, set on the back of the stove, and allow to simmer for one hour, or until thick. Pour out into a dish, and let stand until next day; then add a cup of whole-wheat bread crumbs and two eggs. Form into a loaf, roll in bread crumbs, put into an oiled pan, and bake one hour. To serve cut in slices, and pour over them a little gravy made of carrots and onions, thickened with flour and seasoned with lemon juice.

VEGETARIAN MAIN DISHES

Baked Beans.—Soak one quart small white beans over night, drain and simmer; then add one cup milk or cream, two tablespoons butter, two chopped onions, one teaspoon salt. Turn into a bean-pot or baking-dish, and bake in a slow oven six hours, adding water occasionally if necessary.

Baked Cabbage with Cheese.—Cut the cabbage the same as for cole-slaw. Parboil a few minutes. Put into a bake dish alternate layers of cabbage, white sauce, and grated cheese, seasoning to taste. Continue until dish is full, having cheese for the last layer. Cover with bread crumbs and bake until brown. Serve in bake dish.

Baked Rice with Cheese.—Add alternately cooked rice, cheese, and a little salt, until the baking-dish is full. Pour a little milk over the top and cover with buttered bread crumbs. Bake until a delicate brown.

Creamed Asparagus on Toast.—Use one can of asparagus. Drain off juice, and cut into small pieces. Use juice to make a white sauce, and serve all on toast. Garnish with parsley. This makes a very good breakfast or luncheon dish.

Lentil Cutlets.—Soak over night one cupful of dried lentils, and one-third cup of dried lima beans. Drain, add two quarts of water, half an onion, a stalk of celery. Cook until soft, remove the seasonings and rub through a sieve. Add one cup of stale bread crumbs, one beaten egg, seasoning to taste, and the juice of half a lemon. Melt one tablespoon and a half of butter, add one tablespoon and a half of flour, and pour on gradually one-third cup of sweet milk. Let cook until smooth and thick, and add to the lentil mixture. Set aside to cool. Then form into small cutlets, dip in beaten egg, then in powdered cracker crumbs and fry to a golden brown. Drain, and serve with tomato sauce.

SANDWICH FILLINGS

Cheese and Onion Sandwiches.—Grate the cheese and mince the onions very fine. Use in proportion as desired. Mix well with enough mayonnaise dressing to make it a proper consistency for spreading. Use between well-buttered slices of whole-wheat bread.

Date Marmalade Sandwiches.—Pit the dates and soak in just enough lukewarm water to cover them, for several hours. Mash or

run them through a colander. Serve between buttered whole-wheat bread.

Nutted Cottage Cheese.—Take peanut butter or ground nuts of any kind desired, and mix thoroughly with cottage cheese. Use enough nuts to merely give it a nice color.

Sandwich Cream Toast.—Select some well-browned dry toast. Spread thickly with butter and add a generous layer of grated cheese. Place three or four of these in a cereal bowl in sandwich form, one on top of the other, with the buttered side up. When ready to serve, pour over this a cup of hot milk. Part cream may be used if desired, but the butter and cheese make it very nourishing and appetizing.

SOUPS

Chicken or Turkey Soup.—Cover the bones, skin, etc., left from roast chickens or turkey with cold water, add one onion, a little celery, one-quarter of a bay leaf, bit of red pepper, and cook three or four hours. Strain, skim off the fat, add salt to taste and one cup of cooked rice, which should be thoroughly heated. Serve soup hot, in cups with toast.

Cream of Asparagus Soup.—One bunch or can asparagus, juice of small onion, one pint milk, one-half cup cream, two and one-half tablespoons flour, two tablespoons butter. Wash the asparagus, cut off the tender tips and boil separately until done; then skim out and set aside. Cut the rest into pieces and boil until very tender in the water in which the tips were cooked. Season with a little pepper and onion juice. Mash through a sieve. Add the hot milk and cream. Thicken with the butter and flour rubbed together, and add the asparagus tips. Season to taste.

Cream of Celery.—Two stalks celery, two tablespoons butter, two tablespoons flour, one cup milk, a little parsley, salt to taste. Boil celery in water until tender. Drain off water and rub celery through sieve. Add milk. Stir butter and flour to a paste and add this slowly to the heated milk and celery. Add the minced parsley and season with salt to taste. Cook until thick. Serve hot, with salted wafers.

Cream of Tomato Soup.—One can tomatoes, one and one-half pints milk, three tablespoons butter, five tablespoons (level) flour, celery salt, one onion, salt to taste. Heat tomatoes and run through sieve. Add the heated milk and minced onion to tomatoes and cook until onion is tender. Rub the flour and butter to a paste and add

slowly to the tomato mixture. Season with celery salt and salt to taste. Serve hot.

Cream Potato Soup.—Eight potatoes, two onions, two to three ounces butter, one and one-half to two pints milk. Peel the potatoes and onions and cook in just enough water so that it may all be boiled off. Mash thoroughly, adding butter. Stir thoroughly with heavy spoon and gradually add the boiling milk. Salt to taste.

Purée of Navy Beans.—Three cups of cooked beans, one minced onion, two cups milk, three tablespoons butter, one tablespoon flour, pinch of pepper, a little parsley, salt to taste. Proceed same as in making cream of tomato soup.

Purée of Lima Beans.—Three-quarter pound lima beans, one onion, two stalks celery, three tablespoons butter, two tablespoons flour, one pint milk, a little chopped parsley. Soak the beans over night with the onion, parsley and celery. In the morning put over the fire in three pints of water and cook till water has been boiled down one-half; then put through a sieve. Mix a white sauce of the butter, flour and milk, then pour into the bean purée and season to taste. Stir till all is smooth and hot.

SALAD DRESSINGS

Egg Yolk Dressing.—Allow the yolk of one egg for each person, or if you have no use for the whites of egg, use one egg for every two salads served. Whip the egg lightly; then add two tablespoons of olive oil and lemon juice enough to suit the taste. If still accustomed to the use of salt, a slight pinch may be added to the above mixture; then beat well. This dressing makes a very appetizing addition to any vegetable salad.

Evaporated Milk Dressing.—One cup unsweetened evaporated milk, one-half cup salad oil, juice one lemon, mustard, sugar or other flavoring as desired, one teaspoon salt. Beat the milk and oil together. Then beat in the lemon juice and salt and add sugar or other flavors. This dressing is just the right thick, creamy consistency. It is somewhat less fattening, but otherwise more nutritious than mayonnaise, and also less expensive and easier to make. It must be made fresh each time.

French Dressing.—One-quarter cup olive oil, one-half teaspoon salt. two tablespoons lemon juice or vinegar. Put the oil, lemon juice and salt into a bottle and shake until they are well mixed and thick.

Mustard may also be added, if the dressing is not to be used for fruit salads. Delightful variations can be made with this dressing as a basis. It may be thickened by adding some mashed cream cheese, a little peanut butter, the yolk of a hard-boiled egg or (for fruit salads) half a mashed banana. Add chopped olives, or a spoonful or two of chili sauce.

Mayonnaise Dressing.—One egg yolk, one-half teaspoon fine sugar, one-half teaspoon mustard, three-quarters cup salad oil, one-quarter teaspoon pepper, one teaspoon salt, two teaspoons lemon juice. Mix the dry seasonings and add to the beaten yolk. Add the oil, a drop or two at a time, until the egg begins to thicken. Then add a little faster. Now add the oil and lemon juice alternately, thinning with the lemon. Use the ingredients so that the dressing will be thick when finished. The dishes and ingredients must all be cold. This is usually secured by setting them in a refrigerator for some time before the mixing is begun. In hot weather it may be necessary to have the bowl in which the beating is done set in a large bowl of cracked ice. *Mineral oil may replace salad oil, and sugar may be omitted, when this dressing is used in the reducing diet.*

VEGETABLE SALADS

Cooked Vegetable Salad.—One-half cup green peas, one-half cup asparagus, three-quarters cup mayonnaise, one-half cup cauliflower florets, one-eighth cup string beans, one-half cup carrots, lettuce. After the vegetables have been steamed and allowed to cool, mix them, all but the cauliflower, with the mayonnaise dressing. Arrange on the lettuce leaves, and garnish with the little heads of cauliflower. Serve cold.

Combination Raw Salad.—Grind sweet potatoes, carrots, apples, yellow turnips, beets, seeded raisins and pecans in equal portions. Stir salad oil into the mixture and let stand in a cool place for several hours. Serve with a dressing of lemon juice and a little sugar.

Combination Salad.—This salad can be made of as many different vegetables as one may happen to have on hand at this season of the year. They can be chopped or minced very fine, or if preferred cut in small cubes or chunks. If a tart salad is desired, serve with plain lemon juice; but a dressing consisting of olive oil and lemon juice beaten thoroughly together, makes it far more appetizing. Or serve with mayonnaise dressing.

Cottage Cheese and Cabbage Salad.—Mix thoroughly, equal proportions of shredded or chopped cabbage and cottage cheese. Then

stir in a liberal quantity of mayonnaise dressing, or if preferred use oil and lemon juice.

Cottage Cheese and Vegetable Salad.—Select various kinds of vegetables, according to preference, and mince fine. Stir well together and place a generous flat layer on a garnished salad dish. Drop about three spoonfuls of cottage cheese, evenly distanced, on this layer, put a walnut meat in the center of each spoonful of cheese, and pour a liberal amount of mayonnaise dressing over it all.

Dandelion Salad.—Shred lettuce, endive, dandelion leaves, cress, beet tops and spinach. Mix with any nut butter. Serve with lemon juice.

Egg and Beet Salad.—Take three or four large beets, and cube them. Add three hard-cooked eggs, cubed. Add a cooked salad dressing, and serve very cold on tender cabbage leaves.

Egg Salad.—Cook six eggs until hard. Carefully remove whites from yolks. Mash the yolk and mix with minced onion and chopped parsley. Add salad dressing until of the right consistency. Cut the whites into small pieces. Place a spoonful of the salad mixture upon shredded lettuce, sprinkle egg whites over the top and serve.

Garnished Pepper Salad.—Select some well-shaped green peppers, cut off the top and remove the seeds; then place in a pan of cold water and let remain until water begins to boil. Take them out of water and let cool. In the meantime prepare a mixture of vegetables, cabbage, celery, onions and any vegetables that are preferred, chopped fine and thoroughly mixed with the mayonnaise dressing. Stuff the peppers with this mixture, place three olives on top, and serve on a salad dish garnished with lettuce.

Minced Onion and Cabbage Salad.—Chop rather finely the desired amount of cabbage and onions. Some like only a small quantity of onions to merely give the salad a slight flavor, while others prefer half of each. Daintily garnish a salad dish with lettuce or parsley; then put on several spoonfuls of the minced vegetables. Pour a liberal amount of the mayonnaise dressing over this and serve.

Tomato Salad.—Peel and slice fully ripe tomatoes; let them stand for five minutes to drain off the juice; then set them away on ice. When served, cut up the slices, and to each pint of tomatoes allow four tablespoons of lemon juice, the yolk of one egg, and enough salt and mustard to season highly. Stir the dressing lightly through the tomatoes, and serve very cold.

Uncooked Cauliflower Salad.—Break up the heads into the florets, add to lettuce or other simple vegetable, and dress with cream or mayonnaise dressing.

Uncooked Vegetable Salad.—Chop together about one-quarter of a small head of cabbage, one carrot, one onion and three stalks of celery. Serve on lettuce leaves with sliced tomato and French dressing.

Vegetable Jelly.—Two tablespoons gelatin, one-half cup cold water, one cup boiling water, one-half cup lemon juice, one-half teaspoon sugar, one-quarter teaspoon salt, two tomatoes, one cup celery, chopped; one cup cabbage, chopped; one pimiento, cut fine; one cucumber, chopped. Dissolve the gelatin in the cold water then add the boiling water. Add the sugar, salt, and lemon juice, and when cold, add the chopped vegetables. Pour into individual molds and set on the ice. When it is set serve on lettuce leaves. Serve with mayonnaise on top.

FRUIT SALADS

Apple and Nut Salad.—Take equal quantities of walnuts, pecans and almonds chopped rather fine. Use the same amount of apple (also finely minced), as the nut mixture, and stir well together. Then pour a generous quantity of mayonnaise dressing over this and serve on lettuce, tastily arranging a few olives on top.

Apple, Celery and Nut Salad.—Chop apples, celery and mixed nuts of any kind. Mix well together and serve with whipped sour cream, or mayonnaise dressing.

Cabbage Grape Salad.—Chop cabbage very fine. Add a few fresh grapes, and mix thoroughly with salad dressing. Serve on lettuce leaves, and garnish the top with nuts.

Dried Fruit Salad.—Cut into small pieces some figs, dates, bananas, oranges and pineapple; any fruit can be used. In regard to quantity of each, mix according to taste, and use enough oranges to make it very juicy. This is very nice if served plain, with whipped cream, or with the addition of a few nuts.

Fresh Fruit Salad.—One grapefruit, one orange, one bunch white grapes, a few English walnuts. Cube the grapefruit and orange, being very careful to separate the pulp of the grapefruit from the skin, which is bitter. Cut the grapes in halves and take out the seeds. Chop the nuts quite fine. Add all together and serve with French dressing.

Fruit Salad Combinations on Lettuce Leaves.—Orange, bananas, nuts, marshmallow, fruit dressing. Pine apple and cucumber, mayonnaise. Apples, nuts, raisins, marshmallows, lemon juice, fruit dressing. Cherries stuffed with filberts, mayonnaise. Prunes (soaked), celery, nuts, mayonnaise. Pears, celery, nuts, fruit dressing. Pineapple, banana and lettuce, peanut-butter dressing.

Lettuce and Grapefruit Salad.—Cut the fruit crosswise, and pick out the pulp with a silver fork, carefully avoiding seeds and the white bitter membrane. Line a salad dish with white, crisp lettuce leaves; then put in alternate layers of grapefruit and chopped English walnuts, until the dish is full. Pour over it a dressing made of lemon and oil, and set on ice until ready to serve.

FRUIT DESSERTS

Apple and Banana Sauce.—Cook apples as you would ordinary apple sauce. When just about tender, add one or two sliced bananas (according to the amount of apples you use). Finish cooking until both are tender. Remove from heat and add brown sugar to taste. If apples are not too sour, you will not need to add sugar.

Apple, Date and Nut Dessert.—Slice some apples in dessert dishes and sprinkle them with chopped or ground nuts. Tastily arrange the halves of dates on top; sprinkle again with nuts and grated cocoanut. Serve with cream or olive oil. This is also very nice with the juice of an orange poured over it.

Apple Snow.—Cook four apples until very fine. Beat the white of one egg. Add apple sauce slowly, beating all the while. Add one tablespoon grape jelly to this and beat until it is thoroughly mixed. Serve in little dishes, with chopped nuts sprinkled over the top.

Banana Whip.—Use only the real ripe bananas for this dessert. Mash them to a smooth jelly with a fork; then add, in quantity, about one-half as much whipped cream as you have of the fruit, and stir well together. Serve in a dessert dish, and cover with a generous smooth layer of whipped cream. Sprinkle with ground nuts, and neatly arrange the halves of walnut meats on top. Make this dessert at the latest possible moment, for the mashed bananas grow very dark colored if allowed to stand any great length of time.

French Apple Sauce.—Wash and core several red apples, but do not peel. Butter deep, earthen dish, and into this slice in rings not more than one-fourth of an inch thick, the prepared apples. Dot

with a few bits of butter, and sprinkle with brown sugar mixed with a little flour. End with sugar and flour on top. Cover dish lightly with paste, and bake in moderate oven one hour. The sauce should be deep red in color, and thick and juicy.

Fruit Jumble with Honey.—Sprinkle a light layer of prepared dry cereal, in a large cereal bowl. Next add a layer of sliced apples. Pour some honey over this and sprinkle again with the cereal. Then ararnge a generous layer of sliced oranges and nuts. More honey can then be added. It is very nice if served in the plain way, or it can be eaten with cream.

Mock Cherries.—Take equal parts of cranberries and raisins. Cover with water and cook until tender. Add brown sugar to taste. On account of the large quantity of natural sugar in the raisins, very little additional sugar will be required.

Raw Prune Whip.—Soak some prunes over night, in cold water. If a good grade of prunes is used, this should make them as soft as when cooked. Some require longer soaking to be soft enough. Remove the seeds and mash to a jelly. Serve in a dessert dish, and drop three teaspoons of whipped cream, separately and evenly distanced on top. Place the half meat of a walnut or pecan in center of each spoon of whipped cream. If daintily served this makes a very pretty dish.

CUSTARDS

Baked Custard.—Beat five eggs, five tablespoons sugar, one quart milk, one-half teaspoon vanilla, and bake in a moderate oven until firm. If desired, pour the custard into cups, set in a pan of water and bake twenty minutes.

Chocolate Pudding.—One pint milk, one pint whole-wheat bread crumbs, yolks of three eggs, five tablespoons grated chocolate. Scald the milk, add bread crumbs and chocolate. Take from fire and add one-half cup sugar, and the beaten yolks. Bake in pudding dish fifteen minutes.

Floating Island.—One quart milk, five eggs, pinch of salt, four tablespoons granulated sugar, one-half teaspoon vanilla. Put the milk in a double boiler to heat. Beat the yolks of the eggs and add the sugar. When the milk is scalding hot, stir it slowly into the eggs and sugar. (This prevents curdling, which is hard to avoid if the eggs are poured into the milk.) Pour back into the double boiler,

and stir until it thickens. Then add vanilla and set aside to cool. Just before serving, beat the whites of the eggs to a stiff froth with two tablespons of powdered sugar, and drop on the custard in little "islands." The addition of a little ring of currant jelly to the top of each "island" is an improvement in both the appearance and taste of the pudding.

Maple Cup Custard.—One-half cup maple sugar, two tablespoons flour, three eggs, one cup milk, three tablespoons powdered sugar. Moisten the flour with a little milk, mix until smooth, and add to the rest of the milk. Grate the maple sugar and beat with the egg yolks; into this strain the milk and flour mixture. Mix and pour into custard cups. Set them into a pan of water, and bake until the custard is set. Beat the whites to a stiff froth, and add the powdered sugar. Beat until dry. Put one tablespoon on each cup, and return to the oven to brown.

BEVERAGES

Grape Eggnog.—Allow one egg for each person. Beat the yolks and whites separately. To the yolk of the egg, add enough grape juice to give it a fine color. Sweeten with honey. Then pour in a glass. If desired, the white can be sweetened with either honey or sugar. Put in the glass on top of the yolk, and serve.

Grape Lemonade.—Fill a glass two-thirds full of water; add the juice of half a lemon; then fill with grape juice.

Frothed Grapefruit Juice.—One small grapefruit, one egg white, sugar. Extract, strain and boil the juice, with sugar to taste; add the whipped egg white. Pour into a glass, and stir briskly.

Nutted Eggnog.—To the beaten yolk of an egg add a little vanilla and half a glass of rich top milk, enough honey or brown sugar to sweeten, and two spoonfuls of ground nuts; then beat well. Pour into a glass and add the beaten white of the egg, slightly sweetened. Sprinkle lightly with the ground nuts. This is a delicious drink if it is properly seasoned and if a favorite kind of nut is used.

Orange Buttermilk.—One-half cup orange juice, two tablespoons sugar, one-half cup buttermilk, freshly churned. The above portions are for each service.

PART 4

CONTROLLING BODY WEIGHT

IN judging the health and physique of an individual, the weight is commonly regarded as the most important characteristic. While this rule does not invariably hold good, the weight is nevertheless the most dependable guide that casual observation affords to the physical condition. It need hardly be said that it is neither desirable nor necessary that all men and women of a certain height should be of equal weight. It is none the less true that they are not physically at their best when they vary to the extent of a score of pounds or more from the weight regarded as normal for their particular stature.

In the sphere of physical training, the athlete's condition is usually adjudged by his weight, and in the treatment of almost every disease, the maintenance of normal weight is one of the most important objects of the treatment applied. Of course, the presence of excess flesh is not favorable to the highest degree of strength and endurance. Too much weight ultimately means a diseased condition, although the ability to add fatty tissue is really a sign of health. It means good assimilative organs. It means that a large part of the food that is eaten is absorbed and used by the system. Yet failure to attain to the standard of weight usually accepted as the average need give no cause for alarm. Many persons are "thin"—but are in splendid health nevertheless.

At the same time, this side of the question can be pushed too far. There is slenderness and there is real emaciation—and the two are very different. One is natural, the other is not. One's normal weight is the point at which one possesses the greatest degree of strength, endurance and vitality. For instance, a fat man, as his weight is reduced, gradually grows stronger; the thin man, as his weight is increased, gradually grows stronger. Unquestionably, the man or woman who is underweight will develop these qualities hand-in-hand with the gaining of healthy, muscular tissue. And it is the purpose of this discussion to point out plainly just what methods should be adopted to bring one's weight to such a point as to be in the finest physical condition possible.

GAINING WEIGHT BY DIET AND EXERCISE

INTELLIGENT control of body-weight involves first of all knowledge of the causes of the abnormal weight to be corrected. Keeping in mind these causes, as well as the particular conditions of the case under consideration, the next thing to do is to determine whether one wants to gain muscular or fatty tissue. If the gain desired be muscular tissue, the way to secure it is by exercising. Appetite will then usually urge one to eat sufficiently to supply all the energy this exercise involves, and the muscular tissue will be built up by such exercise.

The foods required for the increase of muscular tissue are the proteins, but the actual amount needed is small and will be supplied by any normal diet. There must also be a slight surplus of calories to offset heavy work or exercise depleting that small, but desirable, portion of body fat which every normal individual should carry.

There may be a few instances, most notable in the case of thin women, where it is desirous, as a matter of appearance, to add fatty tissue to the body. In these cases a reasonable surplus of food should be encouraged. Even to gain fat, it is often necessary to take exercise to stimulate appetite and increase the digestive and assimilative powers of the body. To gain weight, a proper balance must be struck between the exercise which will increase appetite and that which will burn up the material which might otherwise be deposited as fat.

In case of weakened digestion or poor appetite, it frequently happens that those foods which the appetite most readily accepts are low in nutritive value. Personal experiments should then be tried with foods of fat-making qualities but which also seem acceptable to the appetite and the digestion. Fat meats are frequently indigestible and are rarely advisable in large quantities. In such cases, the substitutes may be found in the form of vegetable oils, milk, cream, butter and nuts.

In case it is the starchy foods that are indigestible, the remedy may be in the larger use of fats, but this cannot be carried beyond a reasonable proportion, as fat should rarely form more than one-fourth of the total food intake. Starches may be logically replaced by the natural sweets of fruit. Likewise, the heavy cereal starches, such as breads, etc., may be replaced by the more diversified and usually more appetizing forms of carbohydrates found in vegetables such as potatoes, beets, and carrots.

In many cases of thinness, the simple change from the unwhole-

some, innutritious fare of the average table to a diet which modern knowledge approves will work wonders. Instead of meat two or three times a day, potatoes, white bread, pie, or other pastry, etc., substitute cereals, whole wheat bread, eggs, milk, cream, cheese, vegetables in season, fresh fruits and nuts.

Causes of Underweight.—Lack of weight is often caused by a weakness in digestive power and consequent loss of appetite. It is very rarely that weakened digestion is complete or alike toward all types of foods. Hence the person who is underweight from this cause must attempt to find out what types of food substances he cannot digest readily, and attempt to secure his increased food allowance from other types of foods.

The two major types of indigestion that cause underweight are starch indigestion and indigestion of fats. In the one case most of the starch must be replaced by fats and in the other case the fats must be kept down and more starches used. Hyperacidity of the stomach is a disorder that causes starch indigestion and in this case the weight gaining diet must rely chiefly upon salad oils, cream, butter and egg yolk. Mayonnaise dressing, a combination of egg yolk and salad oils, may also be freely used, but it should not contain vinegar and instead only a minimum of lemon juice. Nut butters may also be used but with caution as they are not as easily digested as the simpler fats.

Difficulty in digesting fats is not quite so common. Where it prevails, potatoes and rice are among the easiest forms of starch to digest. In some cases neither starch nor fat can be digested in enough quantity to gain weight. It is then that we must rely on sugars. But of the sugars ordinary cane sugar is the one most likely to give trouble, especially when added to starchy foods. Corn sugar or syrup, honey and all types of sweet fruits are among the most readily absorbed and easily digested form of energy or fattening foods. To this list may be added malt sugar and milk sugar. Very ripe bananas are also excellent.

Milk itself is the best all round weight gaining food. The milk diet, discussed in Volume IV, is one of the most rapid means of gaining weight. In rare cases of fat indigestion skim milk may be used for weight gaining, and its total calories value can then be increased by adding more of these simple sugars such as honey, corn syrup or malt syrup. A simple diet of milk and raisins has been found excellent to put weight on children with tubercular tendencies.

Underweight may be due to various other food deficiencies. One of these is iron deficiency causing anemia. In that case special iron rich foods are called for, such as liver, egg yolk, spinach and sweet fruits.

Failure of digestive powers causing underweight may also occur from lack of vitamin B. In this case the use of yeast extracts or of wheat germ is very good. Egg yolks contain this as well as other vitamins and minerals and are an excellent weight building food. Fruit juices enriched by egg yolks have very excellent properties and are sometimes very effective for weight gaining, especially in cases where milk and cream cannot be taken.

One of the most frequent mistakes made by those who try to gain weight is that of attempting to force down excess food. This is likely to upset digestion and cause still further loss of appetite and so defeat the end sought. It is true that one must eat and assimilate more food in order to gain weight, but the additional food must be added very gradually. An effective increase in the food of only 10 per cent., or say only an extra glass of milk a day, should result in a gain of about two pounds a month. That will amount to twenty-four pounds in a year. It is far safer to gain slowly in that fashion than to attempt quick gains by trying to increase the food by 50 per cent., and upsetting digestion and losing more than one has gained.

Very simple procedures, if constantly followed out, often result in satisfactory weight gains. One of the simplest is the drinking of an extra glass of milk just before retiring. This may be reinforced by chocolate flavored milk powders or any of the simple sugars recommended. Such a nutritious beverage taken just before retiring is most likely to be absorbed without checking the appetite for any of the regular meals. As a consequence of thus adding to the diet there must be no decrease in the amount of foods at regular meals, or this will offset the weight gaining effects of any special or additional foods that may be taken. This must be carefully guarded against by watching to see that the regular foods at the regular meals are not decreased, and that the added foods must be kept at such a moderate quantity that it will not result in checking the appetite or impairing digestion.

In disorders of the stomach and intestines, emaciation often develops. It is from food that we secure the material for building up the body and repairing the daily losses which the manifold vital process and

in weight will not perhaps be so speedily apparent as when following the milk diet, yet marked benefits will be in evidence in comparatively so short a time as to be encouraging.

As in the instance of the milk diet, and for the same reasons, more satisfactory and speedy results will be secured if this regimen is inaugurated with a fast of from one to three days. If the fast were continued to six or seven days, more pleasing results would be secured than from a fast for a shorter period. If the fast is continued longer than three days the amount of food that is prescribed below for the first meal should be decreased from one-half to three-fourths for the first two days after you resume eating, and if the fast is continued to seven days, the quantity of food should be decreased by seven-eighths for the first eating day, and even if the fast is continued for the shorter period, it might be safer to reduce the amount by half.

The daily regimen is as follows:

(1) Immediately upon awakening in the morning, take exercises such as are illustrated here. Follow this with a dry friction bath, which can be taken with friction mitts or two soft bristle brushes. If these are not available, a rough towel can be used.

(2) A few minutes following this, eat some acid fruit and drink from one pint to one quart of sweet milk. For your acid fruit, you can select ordinary apples, peaches, plums, or any fruit of this nature.

(3) Some time during the day, walk until at least slightly fatigued. The distance, of course, will vary in accordance with the individual strength. All the time during this walk take deep breathing exercises, breathing abdominally.

(4) Take your first real meal at noon. This should consist of bananas (very ripe), raw rolled oats or rolled wheat.

Please remember when securing bananas that they should be very ripe. In a thoroughly ripened banana the skin is not much thicker than paper, and the blacker the skin is the better, provided, of course, the "meat" of the banana is solid. The best kind of bananas to buy are those that are ripened with black spots all over them, similar, in a way, to freckles. These bananas, if allowed to ripen in a fairly cool place, will be delicious and can be easily digested in all cases.

Most any brand of rolled oats will be satisfactory provided it is fresh and clean. See that it is not wormy or "stringy," and that it has no "musty" odor.

Pour the rolled oats or wheat into a bowl and add raisins, dates, prunes; figs, or any other fruit that you desire for flavoring. Make

your meal of the bananas and the rolled grain. It is better to eat this rolled grain without moistening, though if you are unable to do this, you can add cream or milk, if you find it appetizing. However, it is far better if you do not moisten it, for you can then depend upon its being thoroughly masticated. You can drink at this meal from two to four glasses of sumik, according to desire.

(Sumik is beaten sour milk. It is prepared as described in Volume IV, Part 4.)

(5) The evening meal should consist of similar foods to the second meal, though you can have whatever variation you may care for in the way of fruit, and you can add nuts of any kind to this meal, as you may fancy. Nuts are very rich. Do not eat too many of them. You can also have a raw egg, in any form you may care for it at this meal, and drink sumik to the extent of your desire.

(6) Before retiring at night, if you can enjoy buttermilk or sumik, a glass or two could be taken advantageously.

When following out this diet, if you are not hungry at mealtime, always wait until the next meal. Do not force food upon the stomach that you do not need, for in this way you entirely defeat the object of the diet. Before retiring, it is suggested that you take three or four minutes' exercise.

Regimen No. 3.—This regimen for gaining weight has been devised for those whose circumstances render impracticable the adoption of the exclusive milk diet or radical changes such as are essential for the observance of Regimen No. 2.

To follow Regimen No. 3 it will not be necessary to make radical changes in your present diet except to insure that it is both healthful and nourishing. The suggestions that have been made regarding a proper diet and right eating should, however, be carefully observed in this connection.

In some cases, for reasons already stated, it may prove best to eat only two meals a day, instead of three. If you find it difficult to go without breakfast, take a cup of hot water, with a little lemon juice.

When the time comes around for your first meal, you will then be able to thoroughly enjoy it. Your appetite will be keen and every morsel of food will taste delicious to you. That means that it will be digested and assimilated, but, mind you, be careful of overeating. Instead of drinking coffee or tea at your first and second meals, drink fresh milk or sumik (see Vol. IV, Part 4 for recipe), using from one to three glasses according to desire.

REDUCING WEIGHT BY DIET AND EXERCISE

THE statement is often made that the fat man is a sick man. Ultimately this will prove true, for fat and excess eating will in time ruin even the sturdiest health. But the impression usually conveyed is that the fat individual is in some way mysteriously different or abnormal. This serves to make extremely fat people feel that they need special care and attention to combat some abnormal condition that they cannot themselves comprehend.

This is not to say that fat persons never are abnormal. Certainly a fat person may have mysterious things wrong with him just as other types may. But such individuals are rare and merely the exception that proves the rule.

We all inherit some normal tendency to store fat. A little consideration of nature's ways and the struggle for existence as it occurs among animals and primitive men will show you why this has to be so.

For our remote ancestors there was no regular food supply, for an assurance of food is an attainment of civilization. The food supply of primitive men as of other animals varied with locality and season. The food supply was varied and uncertain and the normal condition therefore was one of alternating feasting and famine—not an ideal condition, but a necessary one. When food shortage or famine occurred those individuals who carried some surplus fuel supply that would keep them going till other food was found were the ones that survived. Those who did not carry fat more quickly perished in the famine periods either through starvation or through lack of fighting power to defend themselves against their enemies. During such times, too, going in search of new food and fleeing from enemies required strenuous activity, and that took a fuel supply far in excess of that required by indoor civilization.

Not that the really obese individuals survived. The excessively obese under primitive conditions were just as much out of the race as the starved. Nevertheless the statement holds that the ability to quickly store up fuel in the form of fat when food was abundant was necessary to survival, and that this ability is a part of our inheritance.

But with the coming of civilization and the growing and storing of crops, we have a situation of food being available at all times—365 days in the year. And not only are people offered food more regularly under civilization, but they have less physical activity and hence

less real need for food. Worse yet, the foods of civilization are more concentrated and refined and hence more fattening. Foods are also ground and cooked till they can be eaten more quickly and spiced and flavored to offer artificial temptations to the appetite.

With all these things at work the remarkable thing is not that so many people are fat, but that all of us are not fat. One reason that some of us are not is the growth of intelligence that keeps us from always eating our fill. Another is the breakdown of digestion from overfeeding and rich feeding until it loses the power to handle the excess foods. This last situation accounts for the Jack Sprat families so often seen, in which a husband is as thin as his wife is fat, or vice versa. Such couples have been eating wrong foods and in one case the digestion was destroyed and in the other, because of better digestive strength, obesity resulted.

But we must also grant that there are many persons who are able to maintain a normal body weight throughout their lives without conscious effort. These are the people in whom the instinctive regulation of the appetite is still working as it works in the majority of wild animals.

An ordinary animal even when food is superabundant does not eat to destruction. It does take on some extra weight, but it stops within reasonable limits. Some reaction takes place that causes the animal's appetite to fall off as it fattens, so that the weight is maintained at somewhere near normal. Many people have kept that instinctive control of appetite, whereas others have lost it to a greater or less degree, just as cows or horses kept in a barn may founder when they break into a corncrib or a cornfield.

Just what causes this instinctive regulation of appetite to be lost by some and retained by others is difficult to say, but it can be cultivated and preserved by those who will give a little attention to the matter and who will watch for the instinctive signal that enough has been eaten instead of ignoring it and persistently stuffing.

The kindest thing that we can say of those who are struggling with obesity is that this natural appetite control is not well developed in them. And yet there is a limit in every case, a degree of protest—otherwise people who start to fatten would just keep on fattening till they all became circus monstrosities. A man may easily gain a half pound a day for a while, and that in ten years would be a ton.

So you see the difference between people who instinctively balance their food intake to keep them at normal weight and those who keep

their weight at ten, twenty, fifty or a hundred pounds above normal is merely a matter of where this instinctive check on eating begins to be effective.

No other explanation is necessary, and efforts to complicate matters with mysterious causes and theories of obesity have been chiefly promulgated simply to make business for frauds, who want people to believe that overweight is caused by something beyond ordinary natural causes and needs mysterious or dangerous treatment that the promoters of such theories have to sell.

Exercise for Weight-Reduction.—The primary purpose of exercise for weight-reduction is to burn up as much fat as possible. This means that the exercise must be of a vigorous nature and be kept up for a sufficient length of time to consume an effective quantity. Leisurely walking or strolling will not gain noticeable results. Nor will movements of the arms with or without wands or light dumb-bells be effective.

Even heavy straining tests such as chinning a pole, or lifting a weight, or jumping, or even short sprints, do not have much effect because these movements, while tasking the full strength, are of but a short time in duration. Vigorous exercises that make one use his lungs to their full capacity and sweat profusely, and that are enjoyable enough to be kept up for a considerable period, are in this class.

Hiking for long distances and at a gait that will make one breathe to full capacity will be effective. There is a marvelous difference between the effect of slow walking and very rapid walking, in fact the latter pace is a more energetic exercise than running at the same number of miles per hour. Walking a mile a day will not do much; what you want is a walk of five or more miles a day, or from one to two hours' vigorous exercise.

Indoor exercises for men that are as effective as fast walking and running are boxing and wrestling. Swimming is good, of course. Vigorous dancing also may be made a strenuous exercise.

We have stressed the importance of moderately heavy and long continued exercise if one is to burn up much actual surplus fat in that fashion. But there is another reason for exercise in the general reducing program. Fat people have usually been inactive; this fact together with the infiltration of the muscular tissue with fatty cells has resulted in a deterioration of the muscles. The bodily form, such as it is, has been made by a fat distended skin. If this fat be removed by fasting or dieting, the remaining bodily structure will lack in sym-

metry and strength. Therefore it is highly desirable to build up the muscular structure while one is removing the surplus fat. One may not reduce quite as many ounces per week if muscular tissue is being added while fat is being removed, but the final result will be decidedly more satisfactory.

The muscles that are most likely to be deficient in the fat person are those of the trunk and arms. The leg muscles will not be particularly undeveloped for the reason that even the laziest fat man, if he walks at all, will have given his leg muscles exercise because they have been lifting extra weight. Not so the muscles above the hips. The fat individual sparingly stoops or bends the body. The movements of his chest and arms have also been constrained and hampered and will need development.

Most essentially of all will be the development of the abdominal muscles. Here the presence of fat has most distended and deformed the body, and the only way to restore the form to grace and beauty is to develop the muscles. The very best set of exercises that can be taken during a program of reduction are those applicable to the abdominal region. Such exercise will have to be graded as to difficulty, or they may be too strenuous at the beginning for the person who is overweight and who has not been exercising.

The least strenuous movement will be the alternate lifting, while standing, of first one knee and then the other. A second movement a little more difficult is the alternate raising of the legs while one is lying on his back. The third form of exercise in the scale of increasing strenuousness, is to raise both legs at once; this can be made more difficult by lying on your back on a couch with the legs extended and the heels down on the floor. You may need something to grasp above your head to keep your upper body from lifting instead of your feet. Let this suggest the next step in the exercise. Find a place to lie down with something solid to place your feet under and then raise to a sitting position. At first you may have to hold your hands well down to do this. Now you can increase the strenuousness of the exercise by folding your hands on your chest, and next back of your head. Finally extend your hands at arm's length above your head. Still further power can be put into this series of exercises by holding weights in your hands at arm's length above the head, and better still by lying on a couch or other object with your feet held down and your body from the hips upward extending over the edge of the couch so that it can bend below the level of the couch. When you have reached a point where, with

your feet strapped firm, you can bend your body down backwards from a dining-room table and, with your arms fully extended, pick up a five-pound flatiron from the floor and then come back to a sitting posture—you will no longer need reducing treatment provided your diet is correct.

We have outlined this series of exercises in full because they give such an excellent range of strenuousness from those that the fattest person can begin with to those that require the physique of a gymnast. And all of them are right to the point of applying the remedy to the region that most needs it.

As to reducing fat in certain sections, as long as exercise of some sort is desirable and necessary for the best results of weight reduction as a whole, certainly there is nothing to be lost by exercising the muscles of regions where the fat is most objectionable. One thing is sure, it will not make the region any fatter.

Is Fat Inherited?—All the attributes of every individual are the combined product of inheritance and environment. That is, we have inborn and acquired characteristics. The color of the eyes is pure inheritance. But the language we speak is purely an acquired characteristic. But with many other traits it is not so easy to say what is inborn and what is acquired.

It makes a very practical difference how this question is answered for this reason. People feel that if a trait is inherited or inborn there is nothing they can do about it, whereas if it is an acquired characteristic they know that it is within their power to do something and that the fault is their own if they do not overcome obvious defects that are not inborn.

Fat people are subconsciously looking for an excuse to remain fat because they like their habits of eating and indolence. Tell such people that fat is inherited and the chances are that they can readily discover one or more fat ancestors and decide that they inherited fatness or the tendency toward fatness and hence will have to accept their handicap.

But there is really very little evidence to support the theory that obesity or even the tendency toward it is inherited, unless you consider that tendency to consist of a fairly good digestive apparatus. The latter may be inherited and if one is to become fat it is absolutely essential. It is an asset which the obese turn into a liability by abusing it.

In order to learn just how much inheritance of fat or the tendency

to acquire it exist, one would have to study people who had been removed from their parents in infancy and raised in some place like an orphan asylum where large numbers of children are treated alike.

The fact that you have parents who are fat or brothers and sisters who are fat does not prove any inheritance when you have all been reared at home and taught the same habits of eating as were practiced by your parents and taught to your brothers and sisters. Children adopted in infancy into a fat family would be just about as likely to "inherit" the family fatness—unless as adopted children they were not given their fair share of the food.

In other words, what is commonly called inheritance in this respect is early training in wrong eating habits. These habits can be corrected. People who insist that they cannot are merely ignorant or weak-willed. Many thousands of individuals that came from such fat families have broken away from these habits and have either prevented obesity or remedied it, and this leaves little excuse for others not doing the same.

Many writers on this subject confuse obesity or fatness with bodily build. They state quite correctly that short blocky forms and tall slender forms are inherited types. This is quite true as far as the height of the man in proportion to his breadth and weight of bone is concerned. But short people are not photographic reductions of tall people any more than a baby is a photographic reduction of a man. If a man is broad of frame naturally he will be heavier in proportion to height than a slender-framed man. But that does not give him any more excuse to accumulate excess fat. In fact as far as appearance goes the effort would be quite the opposite, for the slender-framed person will look better with more fat and the one with a wider frame can scarcely carry any fat at all without looking too fat.

Exercise and Weight-Reduction.—Diet and exercise are the two safe, sane and effective means of weight-reduction or the elimination of fat from the body. Either one of these means may be effective alone, but the proper use of the two together is always more effective, not only for the actual reduction but for the general vitality and health building that should go with it.

Diet is the more important because when carried out according to proper instructions it never fails to be effective. Attempting to reduce by exercise alone may prove a disappointment, because it is quite possible and even probable that, if no attention is paid to diet, the person trying to reduce by exercise will eat as much or more fuel food than the additional exercise will oxidize. If that happens there will be

no reduction. Instead it is even possible for the weight to increase from excess food or from the growth of the muscles brought about by exercise.

Of course the development of the muscles is a fine thing in itself and may offset many of the ills that were due to the inactivity induced by the obesity. But overweight people want to get rid of their fat and build up a good set of muscles to replace this unsightly and useless tissue.

Attempts at local reduction of certain parts of the body are chiefly effective in strengthening these parts and improving muscular tone The exercise here illustrated is performed by standing with the feet wide apart in the position indicated and with the arms outstretched at full length, pivoting at the waist to swing the body first to the left and then to the right. The entire movement is reversed and performed as often as endurance will permit.

The results to be obtained from this exercise depend upon the degree of vigor with which it is performed. The movement is begun by standing erect with arms at side. Bending forward in position shown first one hand is brought to the floor and the body brought back to an erect position, then the other hand brought to the floor in the same manner. The entire movement should be repeated, using both hands alternately to touch the floor in the manner illustrated, as often as endurance permits.

But we must not forget that the idea of extreme slenderness involving a lack of both fat and proper muscular tissue has no endorsement from any physical culture or health ideals and cannot be too strongly condemned.

To understand the relative effects of diet and exercise in weight reduction we can translate the actual reducing effects of a given amount of exercise into terms of the amount of calories of food that such exercise will destroy. This relation was very effectively demonstrated by the physical culturist mentioned later in this Part, Mr. George Hasler Johnson in two fasts. In the first of these Johnson fasted for thirty days

and lost twenty-two pounds or .73 pounds per day. In the second one he fasted for twenty days and lost thirty-seven and one-half pounds or 1.87 pounds per day. During the first fast he took the accustomed exercise of an office man athletically inclined, which involved considerable walking. But during the second fast he made his famous foodless walk from Chicago to the top of the Allegheny mountains east of Pittsburgh. The extra 1.14 pounds of weight which he lost per day was consumed by the additional exercise of walking about thirty miles per day. Figuring this down we find that a mile of walking will consume little more than a half ounce of body weight.

This movement is begun by standing in an erect position with the feet sufficiently wide apart to permit taking the final position of exercise as here shown. The hands at first are stretched high overhead then brought down to pass between the calves as far back as possible, as illustrated. The entire exercise is to be repeated as often as possible without taxing the person who performs it.

The body weight lost in any event is not pure fat but always involves some water and also in case of a complete fast some protein material as well. Hence in order to translate the effect of exercise into terms of food units we must resort to the calory system, by which we can measure the effects of all foods, as well as of all exercise. Such investigations accurately checked under laboratory conditions have shown that ordi-

nary slow walking at the rate of three miles an hour on level roads results in the burning up of about 150 calories per hour or fifty calories per mile in the body of an average sized man. Either more rapid walking or carrying a load while walking or walking up hill will increase this rate. Now ten of the food portions as given in the reducing diet at the close of the present part average 100 calories each, or 1000 calories for the complete diet. For an average individual for whom 2000 calories would be a weight maintaining diet, there is therefore in our reducing diet a shortage of 1000 calories.

Since ordinary walking consumes fifty calories a mile, one would have to walk twenty miles a day to get the same rate of reduction that the diet would cause. As very few fat people are capable of walking twenty miles a day, you can see how much more practical it is to rely on diet for the main reducing effect than to rely wholly on exercise, beneficial and helpful as it may be.

Of course there are other forms of exercise that are much more strenuous than walking at three miles an hour. Men in excellent muscular condition and used to exercise are able to burn up a maximum of about 600 calories an hour. This is about the amount burned by professional runners, bicycle riders and mountain climbers when putting forth their maximum efforts for periods of from one to three hours. Therefore in a period of a little less than two hours it is possible for such a man to get the same reducing effect as our diet supplies. But it would not be possible for a fat man to do so, much less a fat woman, because they have not the developed muscles or heart action to sustain such great effort.

It is therefore advisable to make exercise secondary as a means of reducing and to begin exercise gradually and increase it as the muscles and heart develop strength and the encumbering fat decreases and makes movement easier.

It is also wise to go about a week on your reducing diet before you begin any exercise other than that which you have been accustomed to taking. The reason for this suggestion is that exercise stimulates the appetite, and increasing the amount of exercise at the same time you decrease the amount of food will make the appetite demand greater and make the program doubly hard to follow. But after a few days the hunger symptoms due to the lessened amount of food will have been relieved and then the taking of exercise will not result in so great a stimulation to the appetite and will not so increase the difficulties of the battle with hunger.

Of this fact there is a perfectly sound scientific explanation. The

body has two forms of fuel storage. The larger reserve is in the form of fat, and there is considerable fatty substance in the normal body even though it shows no excess or objectionable fat. But there is another, though much smaller, fuel reserve in the form of glycogen (animal starch) in the liver and the muscles. This storage of fuel in the liver is a daily occurrence, the substance being stored there as the food is digested and then drawn upon between meals. This supply of fuel in the muscles and liver is the first drawn upon when fuel food elements are required for muscular action.

As long as one eats all the food needed to satisfy his energy requirements the body fat will not be consumed, but will remain in storage for a possible later emergency. Ordinarily any extra energy needed between meals or because of extra exertion will be drawn from this store of glycogen in the liver. But the moment this is exhausted the oxidation of body fat will begin.

It is reasonable to suppose that this exhaustion of the more readily

This particular exercise is begun in the erect position with the feet sufficiently wide apart to perform the exercises effectively. As one knee is bent and the body brought down, the opposite foot is thrust out straight. The movement is repeated, with the other leg supporting the body.

available liver glycogen would give rise to symptoms of hunger. This is found to be the case in fasting, where the hunger is quite marked for the first three days. After that it subsides and does not increase again until the body fat is about exhausted. This is the scientific explanation of the commonly observed fact that either in fasting or on a reducing diet the first few days are the hardest. After the new habit of living upon the stored fat of the body becomes established it is comparatively easy to continue without the accustomed daily supply of calories directly from the digestive organs.

The total amount of exercise advisable in reduction cannot be prescribed in a book, because the amount advisable for one individual would not be advisable for another. It all depends upon the condition of the muscles and the heart—for the heart is the muscle most utilized in severe or prolonged exercise. One's capacity for exercise depends almost wholly upon the previous training of all the muscles and of the heart.

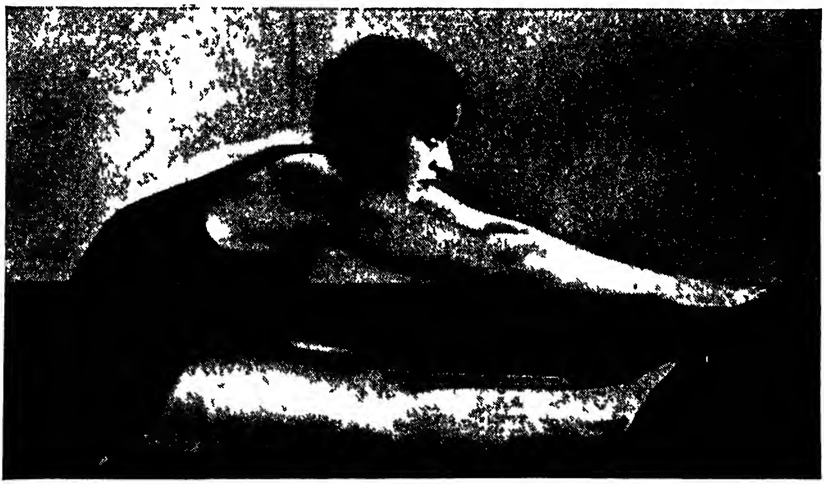
The professional athlete who has allowed himself to become fat—as a boxer or ball player in his off season may—is quite capable of considerable exercise because he has a well developed set of muscles and a strong heart. For him reducing by exercise in his training workout, which generally consists of road running, may be entirely feasible. He can easily burn up a thousand calories of fat a day by three or four hours of running and other active exercises, and thus can rid himself of fat quite rapidly without any restrictive diet at all.

At the other extreme we might find an elderly woman who at no time in life had ever taken any heavy exercise and who after years of obesity had become almost helpless. For her, exercise would have to begin very gradually and while desirable to increase her strength of muscle, yet it would hardly be enough to be appreciable in its reducing effect. For reducing she would have to rely almost wholly upon diet.

Between two such extremes other individuals must govern the amount of exercise by their own judgment of what they are capable of. Nor should it be forgotten that any given motion wherein the body is moved or the body weight lifted is actually a more severe exercise for the fat man than it is for the slender man, simply because of his greater weight. We sometimes fail to give fat people credit for the strength they have because we forget how much weight they must lift with every motion of the body. Before concluding that a man who is a hundred pounds overweight is a weakling because he cannot walk or run a mile without exhaustion, we should picture an ordinary man

doing the same thing with a hundred pounds of flour strapped on his back.

The amount of exercise of which any individual is capable should be judged by the degree of fatigue and exhaustion and by the degree of heart and breathing acceleration. For purposes of actual reducing effects, the amount of time any form of exercise is continued is more important than its severity. Also the larger the muscle masses which are involved in the exercise the more feasible it is to burn up a large amount of fat without fatigue. The muscles of the legs are the bigges muscle masses of the body and also the most practiced in the commonest of all forms of physical activity. Therefore walking is the one best exercise for reduction. Its severity is easily regulated by the speed at which one walks and its total effect easily gauged by the distance This enables the person on a reducing program to begin easily and keep track of his increased efforts as strength is developed. A pedometer, which carried on the person records the number of steps taken, is very useful in gauging the total distance walked. Its use adds interest to walking and encourages one both to keep it up and to gradually increase the total distance. It has the further advantage of crediting one with the miscellaneous walking done about one's daily work as well as with straight away walking on the road.



This exercise is performed upon the floor or upon a bed or a couch, depending upon convenience. Lying at full length with arms and legs extended the body is brought forward and the hands are brought out as far over the feet as possible. The recumbent position is again assumed and the entire exercise is repeated as often as endurance permits.

Another form of splendid general exercise is swimming. The notion is common that swimming is not reducing because there are so many fat people who are successful swimmers. This notion is not true. It must, of course, be admitted that fat, which is such a great handicap as to prevent achievement in other forms of sport, is not without its advantages to the swimmer. Obviously fat helps float a swimmer, so that the fat person needs to expend less energy in keeping afloat and has more energy to put into the forward drive. Also fat is a protection against the chilling effects of cold water, and this may be important in long distance swimming in cold waters. Lastly, in swimming the additional weight of the fat body is lifted by the water and hence the fat man does little more work in swimming a mile than the lean man—whereas in walking or any other form of locomotion he would have to do much more work.

A person can therefore remain or become fat and still be proficient in swimming. However, in spite of these advantages and of remarkable accomplishments of fat individuals who are good swimmers you will not find on the whole that fatness is an advantage even in swimming, for the majority of the world's great swimmers, both men and women, are solid muscle.

What happens when fat persons take up swimming and fail to reduce is that the additional exercise stimulate appetite and digestion

Here is illustrated another exercise to be taken at full length upon the floor, or some suitable object such as a bed or couch. The exercise involves bringing the knee smartly up so that it touches the chest, or as near the chest as possible. The entire movement is repeated, using both legs alternately as often as endurance permits.

and they simply eat more and hence supply more fuel to prevent the oxidizing of the fat. They can do this and still keep up their interest in swimming because the fat offers no particular handicap in that sport. But in any other form of athletics (with the possible exception of weight throwing and some forms of Japanese wrestling) the fat is such a handicap that those who do not succeed in curbing the appetite and reducing soon drop the sport.

You can reduce with swimming as your main exercise very efficiently if you will also follow a good reducing diet.

Reducing Special Parts of the Body.—Besides burning up fat, exercise serves several other purposes. Its further distinct functions, some of them just as important as the demolition of fat, are as follows:

It develops general health and vitality.

It stimulates the circulation and breathing and this aids in clearing the body of waste products and poisons.

It develops the strength of the muscles, a valuable asset in any case, and of special value in the case of a person who tends to fatten, because strength will lead to greater activity in the future and hence less likelihood of lazy habits that will induce the fat to come back.

It develops the size of the muscles, and this means a better and more symmetrical figure to replace the fat figure.

It is the only known method by which one can attack special local deposits of fat.

There are a few individuals who are really well muscled beneath a great coating of fat. But these are the exception, not the rule. Many people who have become fat have ceased all but the most necessary movements and have allowed the muscles to deteriorate. When such individuals reduce by dieting alone they have little form left after the fat is gone. Thus if all fat is eliminated and no muscles are developed to take its place the results in personal appearance may not be pleasing.

Of course if the reduction is rapid the contrast between the new and old body forms is brought into sharper contrast and also there is more danger of the failure of the skin to shrink sufficiently to fit the new form. The remedy for this unpleasant outcome is a combination of greater patience and slower reduction with the development, through exercise, of better muscles and better circulation.

A further reason for insisting on slower reduction and more exercise is that if this policy is followed the fat is less likely to come off unevenly and leave a body with lumpy fat deposits.

The relative ease with which fat is deposited in various regions of

the body varies with the individual case. Yet there is some uniformity. Generally the front of the abdomen is the region where fat accumulates most readily—and is most easily retained. In some cases, however, the entire legs from the hips down become obese. Other and smaller areas may also fatten unduly.

It seems to be a general law that the regions where the fat is first deposited when obesity starts are the last places it will come off during reduction. To many individuals this law of Nature is extremely exasperating. Fat people do not like to admit the full degree of their obesity nor to undergo the long ordeal of exercise and abstention from fattening foods that is necessary for full reduction. Moreover it is mentally difficult for them to picture themselves fully reduced. Thus a man whose normal weight would be 150 pounds has gradually fattened till he weighs 225 pounds. He knows he is fat—and especially that his abdomen is too big. Hence he would like to reduce. But he has no thought of reducing to 150 pounds. He may set his figure at 200 or at 175, but there he proposes to stop. He conceives that he is just naturally broad shouldered and stockily built, even though in youth he may have been lithe and trim. What he is really concerned about is his "stomach."

Women are guilty of similar deceptive reasoning except that they are as often particularly concerned with overfat calves, legs, hips, busts, arms or neck as with the waist line. The women moreover excuse their fatness not by calling it "breadth" or "heavy frame" as do the men, but "plumpness" or a "full figure." In any case the fat individual picks out the most offending part of the anatomy and wants to reduce that without admitting, or at least without fully admitting, the general state of obesity.

It is not possible to decrease the fat most quickly in these particular offending regions; and if it were, the results might be disillusioning. Nature protects the individual by making the first fat deposited the last to go, for if it were the first to go the skin would not have time to shrink and the results would be more disheartening than the obesity. The longer any given fatty deposit has existed the better established is the increased expanse of skin and the more time is needed to permit the necessary shrinkage. People whose obesity takes the particularly offensive form of lumpy deposits are less fortunate than those whose extra weight has been more uniformly deposited. The latter types can safely reduce more quickly, while the former must be more patient and take their reduction by easier stages.

A further fact is that there is no known method that can be depended upon to take fat off of one part of the body while it is being deposited elsewhere—or even while the body weight as a whole is being maintained at a constant figure. To do this would necessitate the moving of fat from one part of the body to another. It would involve the blood picking up fat from particular tissue when the blood was already full of fat. This simply does not readily happen. The only way the fat can be removed from the fat cells is by the blood, and the only time the blood will remove it is when the blood is fat-hungry because fat is being burned up and oxidized in the muscle cells more rapidly than it is supplied from the intake of food. Evidence that this process goes on in just this fashion is found in the fact that there is actually more fat in circulation in the blood of a fat person who is reducing than in that of a normal person on a normal diet. This extra fat has passed from the fat cells and is on its way to the muscular tissues where it will serve as fuel for heat and energy.

The case of favoring local parts of the body in reduction is not, however, hopeless if the effort be combined with a general reducing process. When by a proper system of diet the blood is made fat hungry then anything that tends to disturb or dislodge the fat in any given locality will tend to make that particular fat pass into the blood somewhat more rapidly than the fat from other regions.

Both massage and tight bands or supporting garments are used with this intent and if such methods are combined with the general reducing effects of diet and exercise they may be of some utility.

Importance of Careful Weighing.—For your own encouragement and satisfaction, as well as for your guidance in reducing steadily and at a proper rate, careful weighing is highly important.

People sometimes give up their efforts to reduce simply because they are deceived by errors in weight. They usually make a good start and note a good weight loss. Then they ease up a little on the strictness of the diet. The slower reducing plus a chance error in weight make it appear that they have lost nothing for a period or have perhaps actually gained. When this happens they become discouraged. If they are not well grounded in diet, they reach the illogical conclusion that they "just can't reduce." Their hankering for fattening foods, born of years of appetite indulgence, is thus bolstered up by the error. Away fly all plans of reduction, and an orgy of gluttony follows that undoes all the effort made.

Errors in weight that show too great a reduction are really quite as

bad as those that show too little. If it appears that in one week you have lost five pounds, it is highly probable that the last recorded weight is too low. When the error comes out at the next weighing, it makes it then appear that you have lost less than you really did. Only the average trend of weights day after day and week after week shows what is really happening.

Good scales are very useful, but good scales are expensive and most people must resort to less expensive scales or to the use of scales they do not own. In the latter case some people from carelessness or necessity weigh on different scales. That is most dangerous since no two scales ever weigh just alike. It is much more important that you weigh on the same scales than that the scales be accurate. This does not mean that the scale should not be sensitive, but that it makes no difference whether a scale overweighs or underweighs a few ounces or even a few pounds, provided it always weighs relatively the same. Any scale will do that if it is not tampered with. Therefore always weigh on the same scale, your own if you can afford one, or if not some public scale or store scale which is convenient for you. If you are traveling and cannot do this then you had better trust to girth measurements to judge your reduction and not bother with scales except at long intervals.

The errors in the scales themselves are not the only errors in weighing. Variation in the weight of clothing is just as deceiving. A bathroom scale avoids all this and is of course the most satisfactory. Where you must use an outside scale you should dress in clothing of the same weight, or else know what your clothing weighs.

But there are still factors of error even when you weigh on your own bathroom scale. Common sense should tell you that food or water just taken into the stomach are not true body weight. Likewise the excreta of the bowels and bladder lead to minor errors. The most accurate weight is that taken in the morning after emptying the bowels and bladder and before you have taken any food or water into the stomach.

There is still another cause of error that is more subtle than any of these, and that is the water held in the tissues. This will vary somewhat in accordance with the food eaten, the exercise taken, and the exposure to heat or other causes of perspiration. The Turkish bath gets its reputed value as a means of reduction by sweating out large amounts of water from the blood and tissues. In any such case it may take some time to fully restore the balance. The losses of numbers

of pounds observed in strenuous athletic events like football games and rowing races are mostly water losses.

The immediate increase in weight from hearty eating is mostly due to water in the digestive tract, rather than the dry elements of the food. It takes several pounds of water to keep each pound of food in the semi-liquid condition in which it is held during digestion. Added salt in food greatly increases the amount of water which the body will retain. This may amount to several pounds. One of the deceptive measures of some reducing "experts" is to prescribe salt-free food. As most people eat far too much salt this may be a good thing, and it makes a showing of reduction for the new patient. But reducing body water is not reducing fat, and any tendency toward the belief that reducing is easier than it really is always results in later discouragement.

Perhaps the most common case of this kind is the almost universal good showing of the first few days on a reducing program. If the program involves exercise or sweating or the reduction of salt in the diet, decrease of body water will contribute to a temporary weight reduction. But also the general lighter diet will result in a decrease in the food and water content of the entire digestive tract. This loss will be held as long as you are on the light diet, but it will show only during the first few days, or the first week, if you use weekly weighings, and you cannot count on any similar loss in later weeks. For these reasons you rarely can judge at just what rate you are reducing till you have a record of the loss of weight during the second week.

The type of diet recommended later in this discussion will not, because of its greater bulk and because of the bran and leafy vegetables, involve this error as much as will some other types of diet. That, however, is not the reason for the bulky foods being recommended; the reason is that such bulk makes less hunger distress and gives better bowel action.

On the whole weekly weighings give the most satisfactory records. But if you have your own scales a good plan is to weigh each week three days in succession, average the three weighings and record the result as the weekly weight. This will overcome petty errors and give you a more dependable record of the real results.

Judging the Body "Weight" Without Scales.—What the scales tell you is only part of what you want to know. You are also interested in your health and your appearance. Therefore you should consult your mirror in judging your bodily condition and your prog-

ress towards its betterment. A full length bathroom mirror is the best anti-fat orator in the world.

By tricks of clothing you can disguise your condition somewhat to others, a practice which may be excusable; but unless you are so cowardly as to undress and bathe in the dark you can't disguise it to yourself. So don't try to; instead face your undisguised appearance squarely and get acquainted with the exact nature and causes of it.

Examine the fatty deposits of the body not only by their appearance but by studying out the actual deposits of fat as distinct from the underlying muscular issue. Learn to tense all the important muscles of the body—it is good exercise as well as very revealing of your actual bodily condition. With the muscles tense beneath the layers of fat, you can then determine by grasping the overlying fat just how much fat is present in each region.

While it is hard to record such observations in terms of accurate measurement, you can become familiar with your condition and can judge better your actual degree of obesity in this fashion than you can by weighing or any system of measurements. It is easy enough, once you face the facts, to get in this practical way a very clear conception of just how much fat you carry. Especially is it easy to judge abdominal fat in this way. If you have trouble tensing the muscles by mere mental command, then lie down, place your feet under some object and raise your head and shoulders up as if starting to come to a sitting posture. While these muscles in the abdominal wall are thus tensed you can grasp the fat and pinch it up in loose rolls and gauge with your hands the amount of it.

This external abdominal fat is almost always present and is always objectionable. It will give you the most satisfaction to see it come off. You can therefore gauge your progress in reduction in this manner in a way that is more convincing than the cold figures of any scales. Of course the change will be slow, but if you stick to your reducing program it will be sure.

The use of a tape measure to take the girths of the body is another method that you will find to be a very good supplement to the scales. But taping the body, like weighing, does not distinguish the difference between underlying muscles and overlying fat. Hence the above method of observing the fat itself as distinct from the muscular tissue of the body is the best of all for either judging the real condition or noting real proof of its improvement.

The following girths of the body are the ones commonly taken,

this procedure being fully described and illustrated in Volume II, for men in Part 3 and for women in Part 7. Wrist, forearm at largest point, upper arms at the swell of the biceps, neck, chest, waist, hips, at largest girth with tape held level, thigh at highest point with tape held level, knee directly over kneecap, calf at largest point, ankle at smallest point.

The chest can be measured at three points: directly under the arms, directly over the nipples (or the bust measurement for women) and over the lower ribs beneath the breasts. The waist measurement is supposed to be the smallest girth between the chest and the hips, but in case of obesity this point is hard to find—or there may not be any such point. As the main purpose in such measurements is to get comparisons for future measurements, it is not so important just where or how you take the measurements as it is to see that you take them the same way each time. This applies to just where you place the tape, just how tight you pull it and just how you hold the part of the body being measured. For measuring the obese waist it may be well to place the tape in a sloping position, fitting it into the inner curve of the back and over the maximum bulge of the abdomen in front. This will give you a large measurement but one that will best reveal the actual improvement you want to see made.

If there is someone else that you can call on to take these measurements for you, so much the better, as another person can get them more accurately. But if not, then do it yourself while nude before a full length mirror so that you can see what you are doing and be able to do it just the same way on later occasions Measuring over clothes is a foolish and meaningless sort of operation.

A carefully recorded set of bodily measurements is a very wise thing to take at the beginning of any reducing effort. But don't try to take them too often, as the differences will not be great enough to overcome the unavoidable errors. Just as it is best to weigh only once a week, it is best to measure yourself and record the girths not oftener than once a month.

While the taking of body girths is commendable one should not place too much dependence on such girths in judging what your body form should be. People who are constantly consulting such tables of "normal" weights, ideal measurements, etc., are usually trying to find some justification for their own abnormalities instead of studying their own bodies and admitting the faults with a view to correcting them.

Your instincts will tell you what your body should look like, for

the appreciation of the beautiful in the human body is instinctive. It is true that perverted ideas and fashions may overrule these instincts to a certain extent, but such perverted ideas will not stand a thoughtful examination.

Any free-minded consideration of the human body that allows the instinctive judgment to prevail will tell you that each individual is a law unto himself, and that the ideal form for health and beauty must be judged not by a weight table or a set of measurements, but by the sense of proportions and balance between the parts. This means that a heavier skeleton or heavier muscles change the ideal weight and ideal girths. It means too that the fat beneath the skin must be sufficient to give a sense of smoothness, filling out the irregularities of the muscular and bony form. But when the fat has increased to the point where the fundamental shapes and curves of the body are formed by the fat and the muscular form beneath is wholly lost to view, then your instinctive sense of human symmetry is offended and you will realize that you are not symmetrical, and that the surplus fat is a foreign substance that you should be rid of.

This instinctive sense, once you are persuaded to give it freedom from the bigotries of prudery and fashion, will be a better guide to enable you to judge what your own bodily condition should be than will any set of tables or measurements that you can find in printed books.

How Rapidly Should One Reduce?—People who try to get rich too quickly usually stay poor. Likewise people who try to reduce too rapidly often stay fat—or what is worse they may lose their health and beauty and so defeat the very ends for which they are striving to reduce.

Whether in the pursuit of wealth or health, the impulse to want to attain the end quickly is a natural one—but it is also an unattainable one, and like a child's wish for the moon is not possible of attainment—granted that there are exceptions in the matter of money, for gold mines and oil wells occasionally do make people rich quickly. But there is no way to get thin quickly except by the ravages of some wasting disease.

The greatest speed in losing weight is brought about by a combination of absolute fasting and long continued muscular effort. Probably the most rapid loss of weight recorded for a healthy man was that of George Hasler Johnson, mentioned before. Starting from Chicago, Johnson walked to near Pittsburgh, Pennsylvania, in twenty days

without eating. During these twenty days he covered 578 miles and lost 37½ pounds, or 1 pound and 13.6 ounces per day.

This figure, however, exaggerates the actual fat reduction. Johnson in starting on this walk began a fast and also a grueling physical feat. The fast resulted in the emptying out of the digestive tract while the heavy exercise reduced the water in the tissues. These two factors together caused him to lose eight and one-half pounds the first two days, and much of this particular loss would be regained upon the resumption of eating and the cessation of the excessive walking.

If we omit these two days and consider the loss for the remaining eighteen days we find that it is twenty-nine pounds in eighteen days, or just a little less than one pound and ten ounces per day. We may take this as the maximum rate of actual weight reduction possible for a healthy man of average height by the combination of maximum physical exercise and an absolute fast.

The records of Johnson's previous weight losses in a long fast during which he did no special walking, would indicate that just about one-half of the weight loss in the above test was due to the fasting and about one-half to the strenuous exercise of the long distance walk.

This feat of Johnson's was performed to demonstrate the remarkable power and endurance of the body under fasting conditions. It was not a reducing program, except in so far as Johnson had intentionally fattened up in order to have a reserve fuel supply for the test. Johnson, who is a man of under average height, reduced during this walk from 157½ pounds, which represented for him a very moderate overweight, to 120 pounds, which represented a considerable underweight. Not only was all the fat burned off his body, including what might be considered normal fat as well as surplus fat, but the muscles, especially in the upper part of his body, were also reduced. The muscles of his legs, however, were well protected because of Nature's effort to adjust the body to the demands of his walking feat. At the end of the walk, when he resumed eating, Johnson very quickly regained most of this lost weight.

The purpose of referring to Johnson's unusual feat at this point is to show you what the limits of reduction are. A knowledge of these limits will enable you to check up on some of the claims made for fake reducing schemes and convince you that most of them are fraudulent. In fact any system of reducing that promises you a loss of a pound a day or more is on the face of it fraudulent, unless it assumes remarkable powers of muscular activity. Many of the testimonials and

experiences you hear of that give such rapid losses refer only to the losses of the first few days. These first losses are achieved by the emptying of the digestive organs or the reducing of the amount of water in the blood. Such losses, of course, are not real fat reduction at all—and they are of no benefit or permanence.

There are many objections to efforts to gain maximum rates of reduction as compared with the safer and permanently satisfactory rates of reduction. Among such objections are the following:

Fasting of course is the most rapid way of reducing, and for individuals who learn to fast properly it may be used to reduce weight. The best program to adopt is a series of short fasts interspersed with periods of normal, but not excessive, eating, during which a completely nutritious diet is used. Where this method fails it is usually because the appetite and the assimilative powers of the body have been so increased by the fasting that too much food is taken and the weight lost by fasting is regained when eating is resumed. Properly controlled periodic fasting is a good thing, but for any considerable amount of reducing a steady reducing diet is more easily carried out by most people and in the long run will reduce you just as rapidly.

Reducing by a too meager or a badly balanced diet is dangerous for reasons already explained.

Reducing too rapidly by very strenuous exercise is dangerous for fat, soft-muscled people who are not trained for such exercise. Moreover either of the above efforts is likely to defeat its own end by proving too much of an ordeal for the person who attempts it and usually results in an abandonment of the effort.

Lastly, prolonged rapid reduction is not suitable for those who have been fat for a long time, because the skin will not shrink rapidly enough to refit the reduced form.

On the other hand, we do not approve of the advice very frequently given fat people telling them to cut out pastries, potatoes and a few other such items and reduce in a gradual, almost imperceptible way. That plan rarely works out. Unless the weight reduction is rapid enough so that you can gauge it from week to week on the scales and by other means of judging fat loss, you are almost sure to lose interest, and grow careless or abandon the effort altogether.

A pound a week is often advocated by those who wish to be conservative. But it is really not enough. Errors in weighing often amount to a pound. On such a plan of reduction one never knows where the body weight really stands. Moreover the diet is too nearly

a normal diet and the temptations are therefore greater to forget it and eat like other people. It is best to adopt a scientific and distinctive reducing diet, and stick to it till your ideal weight is reached.

Two pounds a week should be the minimum average weekly loss. This is the correct figure for a woman or small man who depends on diet for reduction without any strenuous exercise. Very large women and average active men can easily and safely attain an average of 2½ to 3 pounds a week. Those capable of strenuous and long continued heavy exercise can boost that figure up to 3½ or 4 pounds a week.

One should not try, over a long period, to reduce faster than ½ pound per day or 3½ pounds a week. Some weeks you may show more—due usually to various weighing errors. But if excessive reduction figures persist for two weeks or more one may add a few portions of extra food and keeping the weight loss down to the advised figure.

Those who have developed badly hanging folds of fat are especially advised to be patient and to proceed cautiously, giving the body form time to come back to normal. Exercising and massaging are both helpful in this restorative process.

If in any case the reduction given one fails to average two pounds a week or better, the explanation will be as follows. Ordinarily such failure will be due either to exceeding the portions or slipping in extra food indulgences. In a very small-boned, light-muscled and short woman, however, the food might possibly be excessive. In that case cut down a little on the portions rather than change the diet.

But in most cases it is better to take more exercise than to cut the diet below our standards, for the standards are necessary to protect the body against possible deficiencies.

Basic Principles for Reducing Diets.—In the light of the foregoing discussion, you are asked to accept the following facts:

First. Fat is accumulated wholly and solely from food eaten in excess of the body's needs.

Second. Fat can be eliminated from the body only by being oxidized or burned up as fuel in the creation of the usual body heat or in generating muscular energy such as that used in the action of the heart, the action of breathing, and the motions of the voluntary muscles in standing, walking, and various physical labors, exercises and sports.

Third. The only time the destruction of the fat can occur is when the amount of food fuel derived from the food being eaten and digested from day to day averages less than the amount consumed in keeping up the bodily heat and muscular activity.

Fourth. The only ways to reduce body fat are therefore to either decrease the amount of food fuel or increase the amount of exercise or to both decrease the food intake *and* increase the amount of exercise.

Such drugs and other substances as are supposed to be reducing are ineffectual fakes or act according to the above stated laws. Some drugs destroy the digestion or appetite so that they indirectly act to cut down the amount of food eaten or digested. Other drugs stimulate the heart action and the rate of breathing and so increase the involuntary muscular exercise.

For the present we will deal with the matter of reducing the amount of food fuel below the normal bodily requirements—which is by far the most important principle of reduction.

The unit of measurement for the fuel value of food is the calory. Since fat is merely stored bodily fuel, we can measure the fattening or reducing properties of any diet by calculating its calory value.

The calory is a unit of heat, or, applied to food, the unit of fuel value that when combined with oxygen will produce a given amount of heat.

All kinds of food have some fuel value, but the amount varies widely. The popular notion that some foods build flesh and others do not is an error. All foods are flesh-building—unless we class as foods water, salt, cellulose and mineral oil. The last two substances are not even absorbed but merely pass through the digestive tract.

Although not strictly accurate, however, the classification of foods as "fattening" or "nonfattening" is nevertheless a convenience. As popularly used it refers to the degree of caloric richness or concentration of calories in proportion to weight.

Thus oil or lard has a value of about 4,000 calories per pound, while lettuce, celery, cucumbers, etc., have a calory value of less than 100 calories per pound. There is a difference here of more than one to forty, and one would have to eat more than forty pounds of these green vegetables to get the same fuel value as from one pound of pure fat. Yet grazing animals on abundant pasture actually do fatten on this very sort of green leafy herbage.

But the cow with her large stomach and her continuous eating digests enormous volumes of such grass. A man would have to eat twenty-five pounds of lettuce or celery or cucumbers a day in order to even keep up his weight, let alone increase it. Practically he cannot do it; hence we are justified from the human standpoint in calling such food nonfattening.

But now consider milk. Because it has a large proportion of water its calory value per pound is comparatively low, being 320 calories. Yet eight pounds or four quarts of milk will furnish about twenty-five hundred calories per day, which is enough to keep up the weight of a moderately active man and would actually prove fattening for a small inactive man or for the average woman. It is entirely practical for a person to consume four quarts of milk a day; in fact five or six quarts of milk a day as used in the milk diet is most excellent program for gaining weight. Not only does such an amount of milk furnish a surplus beyond the amount of food required for daily needs, but being an excellent source of body building elements it is a splendid food to construct new tissue.

Milk therefore has the reputation of being a fattening food, and some people erroneously omit it from a reducing diet. Some milk, however (preferably with the butter fat removed), is highly desirable in a weight-reducing diet. The reasons for this will be fully explained later.

People dislike to be bothered with weighing or measuring their food or to have limits set on the amount of food they can eat. Therefore many popular reducing plans try to ignore any prescribing of food amounts and merely suggest foods that can be eaten freely and of which it is highly unlikely that anyone will eat enough to keep up the body weight. Such plans do not form the most scientific reducing systems. Whether they work at all depends on how strictly the list of foods is made and how much food the individual actually consumes.

A list of foods that includes only bran, green vegetables served without oil, juicy fresh fruits served without sugar and skim or butter milk (which contains only 170 calories per pound as against 320 for whole milk) will prove a fairly practical reducing diet, even though no restriction is made on quantities. But such a diet soon becomes tiresome and there are too many foods that we like that are forbidden. Hence such a mere quality selection of foods with no restrictions on quantities will not in practice be as effective for the reason that fewer people would actually adhere to it. Moreover, without some idea as to the quantities to be eaten, the average person is likely to get a badly proportioned diet that might cause defective nutrition of important bodily functions.

This brings us to the second problem of scientific reduction, which is quite as important as that of merely keeping down the number of

calories so that we will burn up the accumulated fat. This additional problem is to supply in a low calory diet a full quota of *all* other elements of nutrition except the fat-forming fuel.

This group of essential elements includes the protein, which is the substance of which the tissues of the body, except the fat and the bones, are chiefly composed. It also includes all the mineral elements and all the vitamins. Lastly it includes the cellulose or other non-digestible material the presence of which is required to enable the bowels to act properly.

The obese individual has no greater reserve accumulations of any of these elements than has a thin individual. In fact, he often has an actual shortage or deficiency of some of them. This is because the typical civilized diet that produces obesity is very likely to be deficient in nutritional elements other than fuel. Thus obese people are frequently anemic, which means that their blood contains insufficient iron. Or they may be suffering from calcium deficiency or a deficiency of some of the vitamins. The store of body fat contains none of these things but is pure fat in combination with a little water.

A reducing diet that is not scientifically planned may be deficient in one or more of these food components which are essential to health and vitality. This is the reason that reducing by diet is a dangerous business unless the diet is planned by someone who understands nutritional science.

It is quite true that the body has enough of a store of all elements to run for a time; otherwise fasting would be impossible. But a fast for curative or rejuvenating purposes is rarely extended beyond thirty days, whereas a reducing diet may run much longer than that. Readers of *Physical Culture* magazine have reported reduction of as much as 175 pounds. Assuming that such reduction was at the rate of half a pound a day this means about one year on a reducing diet. That means twelve times as long as a thirty-day fast, and were the diet lacking in any element it would mean that the subject would have to have twelve times as much of that element stored as he would to undergo such a fast.

Moreover a diet that is lacking in some particular element even if it is followed for only a month is more likely to work injury than is a complete fast. The reason for this is that the processes of digestion and assimilation make use of and consume certain minerals and vitamins. The digestive fluids are rich in such elements and when digestion is proceeding their supply is exhausted more quickly than

when the function of digestion has stopped as in the case of a complete fast.

Therefore diets that are deficient in any nutritional element are unwise and actually dangerous to life and health if prolonged.

The reason that the reducing diet must be more carefully planned in this respect than the weight-maintaining diet is that the reducing diet is only about half as great in quantity.

A plain arithmetical example will make that clear. Suppose that a person's actual requirement for calcium was one gram a day, and that he was using a diet of ordinary food that only supplied that gram of calcium each day with none to spare. On this plan he would get along without suffering from calcium deficiency.

But now suppose this person should decide to reduce and in his ignorance assume that all that was necessary was merely to eat less. Probably in that case he would make no change in the kind of food eaten. He would on such a reducing diet get only one-half a gram of calcium per day, obviously an insufficient amount, although he would not suffer from any deficiency of fuel food elements because he would have his accumulated fat to use as body fuel. As a result the calcium would be drawn from his bones. But the bones have no calcium to spare and if long continued the calcium shortage would result in serious deficiency disease.

Likewise if a person were existing on a diet that gave him only the minimum protein needed, and he then cut the diet in half, he would be obliged to draw the extra protein from his muscles. He could continue this for perhaps one or two months without serious loss of muscular strength, but if he continued it for six months or a year the result would be weakness or death from protein starvation. It so happens that the ordinary meat-containing diet yields a superabundance of protein and hence a meat eater probably would not suffer from this particular cause even if he reduced the quantity, but a vegetarian might.

This same principle applies to each of the minerals, and to all of the vitamins. But perhaps it can be still more easily comprehended with regard to the factor of constipation. Assume a man is on a diet containing whole-wheat bread, vegetables and other foods that contain just enough indigestible cellulose to give him a normal bowel action. He goes on a reducing diet and cuts the quantity of these foods in half. The indigestible residue will also be cut in half, with the result that his bowel movements may become only half as frequent. As a

matter of fact the practical result is likely to be even worse, for on the reducing diet the digestion will be more complete because of the reduced amount of food. With less roughage and more complete digestion the result will be a bad case of constipation. Therefore special precautions must be taken to avoid constipation during reducing.

In the diet given you later in this Part all these factors have been carefully considered. It is actually a better source of all these vital food elements than is the ordinary conventional diet though that may have twice the quantity of total food.

Because many fat people have had badly chosen food as well as too much of it, they frequently combine obesity from the excess of food fuels with food deficiences from a shortage of other elements. For that reason such a diet as we have given you will often work a double benefit to health, remedying nutritional deficiencies at the same time that it relieves obesity. Without such guidance when reducing you are in danger of bettering yourself in one way and injuring yourself in another. Because of that possibility reducing without proper instruction may cause actual injuries to health.

Many systems of reduction fail because they are not strict enough. Some of these are devised by professors or doctors who follow in the old errors that encourage overeating. Others are devised by men who must cater to the readers to sell them a book or system, and who know that promising people that they can reduce without denying themselves the pleasures of eating will get the sucker's money. So they tell them a few things they should not eat and arrange complicated menus that sound very attractive. The reader sends for the course, looks it over and pays for it. When used, it is found that it does not accomplish reduction.

Even if such a course when strictly followed may reduce many persons' weight, it will fail in practice on two counts. It will fail to reduce the individual whose food requirements are actually small. It will also fail to reduce the individual who through lack of understanding or lack of will-power fails to strictly follow the menus, and therefore gets the quantities of the servings too large, or who occasionally eats additional food.

In the system given you in this Part the diet is far enough below any weight-maintaining allowance to positively reduce any adult. It consists of ten items of food per day. Each item (except milk) is figured to be as near 100 calories as can be conveniently measured. The errors in individual portions as eaten will pretty much average

up from item to item and from day to day. Therefore the average food intake on this diet will range from 1,000 to 1,200 calories per day.

That is a low enough figure to reduce anyone, since the lowest possible figure on which any adult man or woman can maintain weight is about 1,700 or 1,800 calories per day. The more usual weight maintenance figure for an average woman or a small man doing light work is about 2,000 calories. Therefore our diet may be considered half rations. It should reduce one just half as fast as would a complete fast, and since the rate of reduction on a complete fast is from three-quarters of a pound to one pound a day our diet will have a reducing effect of from two to four pounds per week, in the average man or woman.

This rate is fast enough and it is unwise to try to increase it by any further cut in the food allowance below that given in our daily list of ten items. If anyone for a sufficient reason wishes to reduce more rapidly than this then the proper procedure is to go on a complete fast.

Now it is very obvious that large active individuals will reduce more rapidly on a given diet than will small inactive persons. It is right that this should be so. The diet given in this book is the minimum diet that will safely provide for all the nonfattening elements of nutrition. The requirements in these items do not vary nearly as much as does the weight-maintaining or calory requirement. Men in general use more fuel food than women because they have bigger muscles and use them more actively. More muscular work makes use of more calories but little more of vitamins, protein or minerals. In these latter nutritional elements the requirements of men and women, and even of large and small or active and inactive individuals are much more nearly uniform. For practical purposes we can therefore set a single standard of these items and calculate a single basic diet for all. And to go beneath this safe minimum would be decidedly unwise.

But if a large or more active individual does not wish to reduce so fast as the ten unit diet would cause him to he can double up on favorite portions of the diet as given. A large active man could take fifteen instead of ten of these portions per day and still reduce at a satisfactory rate. But for a small inactive woman to do that would ruin the whole program, as she would then be so near her actual food-maintaining allowance that the amount of reduction would

be too small to be worth while and she would naturally get discouraged and quit trying to reduce.

The large active person who finds that this diet will reduce him faster than he likes may also eat other food entirely outside this list with perfect safety if he first eats the ten portions of food on the list. Almost any food he may care to eat would then be comparatively safe for him because this list has been so figured as to include all the known dietetic necessities.

However any such addition of self-selected food involves the possibility that he will eat enough more to ruin his whole effort. This would certainly be very likely to happen if the additional foods were rich in fats. For the man who understands food values and who is capable of exercising reasonable restraint such a permission of some free choice is safe enough. There are a number of tables in this book that will be helpful as a guide for those who have confidence in their ability to work out their reduction with such modification. But those who have not had better stick strictly to the diet prescribed in the concluding pages of this Part. (See *New System of Diet for Weight Reduction.*)

Eliminating Food Fats.—Practical observation of the tastes and food habits of fat persons, and of their failures to control body-weight leads to the conclusion that fat in the food is the chief trouble-maker. Certain more obvious fats they may avoid, such as fat meat or butter spread on bread. But the hidden fats that are either unsuspectedly in natural foods or are placed in foods by the cook are sufficient to ruin their reducing ambitions.

In the first place fat is entirely useless in the diet of a fat person. He already has the fat stored in his body and such fat as the system may require for any purpose or at any point is readily picked up by the blood from the reservoir that Nature has provided. This is not an abnormal process at all. The blood deposits fat or again picks it up from day to day even on a normal diet, as the nature of the foods eaten varies and as the demands for fat as fuel vary according to heat or muscular energy requirements.

When people are getting fat, more fat is being deposited than is being used again. When they are reducing the fat is simply being used up and the deposits or stores reduced. If a person is reducing by living on half rations then half of his fuel requirements are being drawn from the deposits of body fat. This means that he is actually living on a diet that is half fat The body fat in a person who needs

to reduce is superabundant, and to add more by way of the mouth serves no good purpose whatever. Instead it creates two elements of danger. One is that the total proportion of fat to be burned will be too great, and this in some cases results in an incomplete combustion of fat producing a product called acetone. The production of acetone, in turn, results in a very serious form of acidosis. There is special danger of this in cases of obesity combined with diabetes when one tries to reduce and at the same time completely eliminates sugars and starches.

The second danger of using fat in a reducing diet is that with the small quantity of total food permitted the fat used will crowd out needed vitamins, minerals, protein, etc., and result in deficiency disorders. Lastly of course there is the further practical fact that adding fat to the foods will merely defeat the end of fat reduction that is sought.

The reducing diet should therefore be as free as possible from fat. The only exception to this is that a small quantity of the vitamin-bearing fats are permitted.

A diet of pure fat is by far the most unwholesome and destructive diet that can be consumed. In the Physical Culture Laboratory adult rats were fed different kinds of individual foods. The rats living on pure fat succumbed to the unwholesome and unbalanced diet quicker than those fed on any other type of diet. Outside of fats pure cane sugar was the next most destructive; then followed pure starch, and next came white flour. But fat was the worst diet of all. That does not mean that fat is at all times a bad food element. Some of it is desirable in any normal diet. But the civilized habits of cookery make use of too much fat at all times, and this is especially true in families which run to obesity. The supposed inheritance of obesity is frequently the development from the same mother's cooking of the habit of using too much fat and of the acquired taste for such fat-containing foods.

One reason that fat so easily slips into the diet is that it readily mixes with other foods and is absorbed by them and eaten unconsciously. Added fat improves the taste of most other foods—in fact adding fat in one form or another is about half the art of cookery. "Good" cooks put it in nearly everything. Items recommended in a reducing diet list may readily be ruined for the purpose by the fat that is added in cookery. String beans, for instance, rank near the top of the list of effective reducing foods. But if an ounce of butter be added to a pound of string beans they have become more fattening

than plain potatoes. Yet very frequently you will see a fat person carefully avoiding all potatoes yet complacently eating some vegetable like string beans that has been "seasoned" with butter or oil until the calory value is quite as great as that of potatoes. Worse yet, the dish with the added calories in the form of fat is worse than potatoes because it unbalances the diet by increasing the proportion of fat that must be oxidized and crowding out the other needed elements.

But potatoes likewise can richly earn the ill reputation they have of being fattening foods by the addition of fat. This fat may be added to mashed or scalloped potatoes in preparation for the table, or added at the table in the case of baked or plain boiled potatoes. Any form of fried potatoes is still worse, and potato chips are nothing but dried slabs of potato substance that are literally saturated with fat.

The following table will show how quickly the addition of fat to potatoes changes their ratings for reducing purposes. The figures given in the right-hand column indicate the number of ounces that would equal the daily reducing ration of 1,000 calories.

AMOUNT OF FAT ADDED PER POUND OF POTATOES	1000 CALORY PORTION
Plain Potatoes	43 oz.
1 oz. added fat	27 oz.
2 oz. " "	20 oz.
4 oz. " "	14 oz.
8 oz. " "	10 oz.
16 oz. " "	7 oz.

Similar results would occur in adding fat to any other food or mixture of food material. All pastries offend in this respect. Biscuits and crackers are much more fattening than plain bread because of this added fat. In cookies and cakes both fat and cane sugar are added. Soups are good or bad reducing foods depending almost entirely on whether they contain fat.

The chief offense to the reducing diet or to general health from the habit of frying foods is in the matter of the fat absorbed. However, this varies greatly with the nature of the food that is fried. A little fat placed in a skillet to keep lean meat or eggs from searing may give them the name of fried foods and yet the proportion of grease actually absorbed and eaten may be small. On the other hand all

such things as crummed food, patties, and the like, will soak up fat as a sponge does.

Thus oysters as they come from the shell are an excellent reducing food. But a person noting that oysters were reducing and then ordering fried oysters would not get oysters as the bulk of his order but sponges of bread crumbs saturated with fat, and the total effect would be worse for reducing than pork chops.

People are not quite so prone to blunder in this fashion when using salads because the fat added in the form of an oil dressing is more visible as fat. Yet some people are so ignorant of cookery that they do not know that mayonnaise dressing commonly used on salad is practically pure fat. The egg yolk that is its base is high in fat, and the usual recipe calls for a cup of oil to each egg yolk and each tablespoon of vinegar or lemon juice. Salads with any such dressing are worse than useless in a reducing diet, for the best of all reducing foods, green leaves, can with the use of mayonnaise dressing be changed into very fattening foods.

The use of mineral oil as a substitute for ordinary oils in the reducing diet is taken up elsewhere.

In concluding this discussion we give a table showing the proportion of fat in various foods. This is figured on the basis of what percentage of the total calories of the food are derived from fat. It will look very different from some tables you may have been used to because the fat is usually given as a percentage of the total weight. That scheme is very misleading because in a watery food the percentage appears small and so the food appears to have little fat. But the water we eat does not count, but only the food elements. Thus milk containing 4 per cent. of fat in the old form of table is seen to contain 52 per cent. of fat in the correct form of table. This table is not for the purpose of showing the general desirability of foods for reducing but only to show you what foods are acceptable and what objectionable from the standpoint of the proportion of fat they contain. Therefore do not jump to the conclusion that because a food stands high in this table it is necessarily a good reducing food, for there are other undesirable food constitutents besides fat. Thus cane sugar contains no fat, yet it is scarcely less desirable in the reducing diet than fat itself. Any estimate of the percentage of fat in meat obviously depends upon the individual cut. But it should be noted that ordinary "lean" meat contains some fat, either as a part of the food, or added in cooking.

FOOD	PERCENTAGE OF FAT
Cane sugar	0
Cantaloupe	1
Potatoes	1
Prunes	1
Tomatoes	1
Apricots	2
Artichokes	2
Barley	2
Grapefruit	2
Oysters	2
Pumpernickle	2
Rye bread	2
White bread	2
Gelatin	3
Oranges	3
Peaches	3
Radishes	3
Whole wheat bread	3
Barley (entire)	4
Cod fish	4
Haddock	4
Banana	5
Celery	5
Lima beans	5
Sweet Potatoes	5
Watermelon	5
Green peas	6
Onions	6
Pineapple	6
String beans	6
Apples	7
Dates	7
Huckleberries	7
Parsnips	7
Pears	7
Asparagus	8
Carrots	8
Cottage Cheese	8
Raisins	8
Rice	8
Skim milk	8
Cabbage	9
Cherries	9
Dried figs	9
Cucumber	10
Eggplant	10
Sweetcorn	10
Cranberries	11
Wheat bran	11
Whey	11
Buttermilk	12
Fresh Spinach	12
Raspberries	13
Strawberries	13
Grapes	14
Lemons	14
Lettuce	14
Blackberries	15
Cauliflower	15
Macaroni	15
Turnips	15
Baked beans	17
Clams	17
Rolled oats	18
Chestnuts	20
Chicken	20
Cake (average)	25
Beets	26
Buckwheat flour	26
Dried peas	26
Rhubarb	27
Liver (beef)	31
Apple pie	32
Beef kidney	38
White fish	38
Halibut steak	39
Soy beans	42
Roundroast (beef)	45
Mackerel	46
Veal cutlets	46
Smoked herring	48
Unsweetened evaporated milk	50
Beef tongue	52
Milk (whole)	52

FOOD	PERCENTAGE OF FAT	FOOD	PERCENTAGE OF FAT
Salmon	57	Ham	80
Eggs	61	Pork chops	80
Wienerwurst	62	Butternuts	81
Peanuts	63	Green olives	83
Sardines	65	Walnuts	84
Pork Sausage	67	Avocado	85
Sirloin steak	68	Cream	85
Chocolate	71	Brazil nuts	86
American Swiss cheese	73	Pecans	86
Almonds	76	Ripe olives	91
Hazelnuts	76	Bacon	93
Lamb chops	76	Butter	99
Coconut	77	Oleomargarine	99
		All pure fats—(olive oil, lard, etc.)	100

Sugar and Its Use.—Next to the use of fat in the diet the most troublesome element, either in the causing of obesity or preventing reduction, is the use of sugar. Next to fat cane sugar is the worst possible food element that can be used. In our test of laboratory rats, cane sugar followed the pure fat as being the most destructive element to the general health and vitality of the animals that were involved in the experiment.

Cane sugar is worse food than other forms of sugar such as milk sugar, corn sugar or malt sugar. This is true even if the other forms of sugar are equally refined and equally devoid of mineral elements. The reasons assigned for this are various: that cane sugar is more disturbing to digestion, more destructive to normal calcium metabolism, etc.

However, the distinction as far as reducing work is concerned is not important, for all forms of sugars, and starches, too, are fattening. Cane sugar is the worst offender chiefly because it is the most used. The amount of cane sugar used in America per capita per year is over 100 pounds. This is almost one-third of a pound a day. Since a pound of cane sugar yields 1,800 calories the average American's ration of cane sugar is about 500 calories a day. Since the reducing diet should have only from 1,000 to 1,200 total calories the hopelessness of trying to reduce and still consume the usual amount of cane sugar is obvious, for it would form half of the total food intake—

and this half would be devoid of any elements whatsoever other than the pure fuel element.

Of course if the same proportions of foods were eaten during reduction as on the conventional diet the amount of cane sugar would be cut in half, but even that would be bad because we cannot in a reduction diet allot any of our calory intake for a pure fuel element that is wholly devoid of the other essential factors of complete nutrition. The rule in reduction therefore must be practically no cane sugar in any form.

Perhaps this rule against cane sugar need not be quite so strictly enforced as the rule against fat, for the sugar does at least offer its fuel. For this reason certain sweet fruits are all right in reducing from the necessity of burning too much fat. Moreover, an ounce of cane sugar is not as bad an addition as an ounce of fat since the calory content of the sugar is only about half that of the fat.

But these slight advantages over fats do not warrant the use of cane sugar with any freedom. Such sweets as we use should be taken in forms which yield minerals or vitamins or cellulose as well as pure fuel. For this reason certain sweet fruits are all right in reducing diets, but of course even here the quantity cannot be large.

As a practical proposition cane sugar helps to cause obesity chiefly in two ways. One is through the eating of candy. Cane sugar is the chief ingredient of all common candies. The substitution of glucose or starch in candy-making does not help matters appreciably because while not quite such objectionable forms of fuel food yet these are still pure fuels and devoid of minerals.

Other food elements incorporated into candies, such as chocolate, nuts, sweet fruits, fats and even milk, while they may add some variety of food elements, are in themselves highly fattening. Therefore the eating of any candy at all not only rapidly piles up additional fuel or fattening elements but it also increases mineral deficiencies.

Candy offends particularly in that it is an extra indulgence and eaten between meals. It is also a water-free food and so counts up pound for pound or ounce per ounce very rapidly as compared with the moist foods more commonly eaten at meals. Compared with the much-abused potato the calory yield per pound is 1,800 for candy while it is only 370 for potatoes. A pound of candy is nearly as fattening as five pounds of potatoes. It is also more deficient, since the potatoes contain valuable alkaline minerals and the candy does not.

To attempt to reduce while continuing the candy-eating habit is a

venture in which it is almost impossible to succeed, and even if success were attained it would have to be by reduction of vital food elements to make room for the calories from the candy. The results would be highly dangerous to health.

Next to the candy-eating habit sugar makes its chief trouble in reducing because it is added to so many other foods. The fattening effects of sugar are so well understood that most people do refrain from some of the more obvious uses like candy, cakes, syrup and sugar added to cereals. The form in which the harmful cane sugar is most likely to slip into the reducing diet is in its use to sweeten sour fruits or fruit juice beverages.

Sugar and acids do not react on each other chemically as do alkalines and acids. The additions of sugar to a sour- or acid-bearing food does not destroy the acid, but it does modify or disguise the taste. Most of us find this combination of acid and sweet taste very pleasant. Indeed it is the basis of the taste of most tart fruits in their natural forms, of which the orange is an excellent example. But when the acid is higher, as in lemons, pineapples, gooseberries, cranberries, rhubarb, etc., the amount of sugar that must be added to please most tastes is very great and may amount to several times the food ingredients of the fruit itself. Therefore such sour fruits as served are predominantly cane sugar and have a quite high caloric value. Moreover, this sugar, contributing nothing but the fuel elements, increases the danger of deficiency of various other highly important vital food elements.

Because most food tables give the calory value of the raw natural products many people in following reducing diets are prone to consider these low values of the tables and yet eat the fruit in its sweetened form, in which it may easily be two to four times as fattening as the figures in the tables seem to indicate. Thus fresh pineapple, according to such tables, has a fuel value of 200 calories per pound. but canned pineapple (and that is the kind people most commonly eat) has a fuel two or three times as great.

It is easy to see how one may be led astray in his calculations on a reducing diet if this fact about the use of sugar with fruits is not clearly comprehended. The following table, similar to the one we gave showing the effect of adding fat to potatoes, will further impress this point upon your mind. The figures given are the number of ounces of the product that would provide the 1,000 calories of the reducing diet.

AMOUNT OF SUGAR ADDED PER POUND OF STRAWBERRIES	1000 CALORY PORTION
Plain Strawberries	100 oz.
1 oz. added sugar	58 oz.
2 oz. " "	42 oz.
4 oz. " "	33 oz.
8 oz. " "	23 oz.
1 lb. " "	16 oz.

Protein Requirements in Reduction.—The object in reducing weight is to reduce fat, not muscle. The fat individual usually lacks muscle and needs to build it up, not reduce it. These facts have been generally comprehended, and because fat and muscle make up the bulk of the body, one of the earlier ideas of reduction was to eat large amounts of lean meat. It was a natural enough solution for a meat-eating people to conceive, but further knowledge of the science of nutrition showed that the plan was decidedly faulty.

Body fat can be accumulated merely by eating fat, but human muscle cannot be accumulated by eating muscle meat. If it could the way to produce a strong man would be to feed him on lean beef-steak. Muscle cells will not grow from food alone but only from the need for muscular expansion that is brought about by the use or exercise of the muscles. Supplying more "muscle food" than that which is called for by such actual growth demands of the muscles (and other organs) does not help but interferes with and may actually poison the muscle cells.

Furthermore the notion that muscle food, so-called, or protein, is not fattening is an error. All protein that is not needed for actual cell nourishment must be got rid of by the body, since it cannot be stored like fat. This elimination is accomplished in the following manner. The protein molecule is broken into two fractions. The minor part, which contains the distinctive nitrogen element, must be excreted as waste through the kidneys, while the major fraction, which consists of the same elements as sugar, is oxidized like sugar or any other fuel food. All these fuel foods taken in excess of the body's power to oxidize them are converted into fat. Hence excess protein merely acts like starch or sugar and like them will contribute to the formation of body fat. But unlike sugar protein leaves this excess of waste product, which must be added to the normal wastes of the body, placing an additional burden upon the kidneys. Moreover the

minerals of meat and eggs are acid and complicate matters by causing acidosis. There is no benefit during reduction for eating lean meat or other protein in excess of the body's normal protein requirements.

The amount of protein actually needed must be supplied, or the muscles and other vital protein-composed organs will be consumed. When one is not reducing the body requirement of protein can readily be supplied from a mixed diet of grains, vegetables, fruits and nuts, as has been abundantly proven by strict vegetarians. But if such a low protein diet be reduced in quantity to one-half or less of the usual food total, as it is in a reducing diet, then, unless special pains be taken to supply it, an actual protein shortage may occur. This will do no harm for a short time, as evidenced by the benefits accruing from fasting. But in the case of serious overweight the reducing diet must be continued for many months, and then some adequate source of protein must be supplied.

The best source of this is milk, not meat. One very great advantage is in the fact that the milk is an alkaline food, whereas meat is an acid food. But besides that we seem to have evidence that the protein of milk is intrinsically better. This superior quality of milk as a source of food protein is also shared by eggs, although they, like meat, are acid-forming.

Milk and egg proteins are the most efficient known. Less of these proteins are required to produce a given amount of growth in young animals than with any other forms of protein. The reason for this should be obvious, for the function of milk and eggs in nature is to completely nourish and support the growth of the young animal—a calf or an unhatched chicken as the case may be. The seed of the bean or the wheat or nut serves the same function for the young seedling plant. But it stands to reason that man is more like a calf or chicken in his make-up than he is like any plant. Experimental evidence also shows that the milk and egg proteins are more completely used with less waste. The application of this fact to reduction is based on the principle that any protein not adapted to actual cell-building or replacement becomes so much additional fuel, except the fraction that must be eliminated through the bowel or kidneys (and this latter fraction may become a source of putrefaction or acidosis).

From the above discussion you can see the logic of including a moderate amount of these efficient proteins that will suffice to supply all the body's actual needs and the unwisdom of greatly exceeding such an amount. The amount of protein required is estimated as

from forty to sixty grams. Taking the higher figure, for the purpose of leaving a margin of safety, we find that to supply the necessary amount from milk alone we would require each day about two quarts of milk which may be either whole, skim, or buttermilk as far as the protein factor is concerned.

In our reducing diet we have provided for an adequate protein supply of sixty grams. Most of this is derived from milk (including cottage cheese) and eggs. However, no harm will come from the use of one small serving of meat a day as a source of protein, if the milk be used also. To many this meat will greatly improve the tastiness of the diet.

Some people profess a dislike for milk in any form. This rarely extends to cottage cheese, and that milk product can be used as a substitute, with perhaps an increase in the quantity of eggs. If the milk elements for any reason cannot be taken, it will be better to use meat than to omit all concentrated protein, especially if the reducing process is to extend over any considerable period of time. Up to one month these special cautions to get the protein supply are unnecessary, just as they are in a fast.

For strict vegetarians we have introduced in the list one special vegetable protein, a preparation known as Protose. Nuts, commonly recommended as a vegetarian meat-substitute, are not suitable for a reducing diet as they are relatively richer in fat than in protein. Beans, peas, macaroni, etc., are heavy starch bearers and the protein they contain is of poor quality; hence they will not do in a strictly worked out, rapid reducing diet such as we shall outline.

Vitamins and Minerals in Reducing Diets.—The fear of starvation and the idea that persons must eat to "keep up their strength" obsesses the ordinary layman. Indeed, it is reenforced every day in the newspapers. Every time there is a flood, a mine disaster, a man lost in the wilderness, or even a long-distance aviation stunt, out come the papers with scare-head ideas about starvation merely because men may be without food for a few days.

When the body already has a great surplus of pure fuel elements accumulated in the form of fat, that is a good indication that the diet has been unbalanced for some time. If such a diet be followed with a smaller one in which these pure foods still predominate a highly dangerous condition may result.

This possibility is the real foundation for the statement that reducing may be dangerous. It is dangerous only when the evil condition

that already exists in the body is still further aggravated by a badly chosen diet.

But the fact that there are wrong ways to do a thing does not prove that it should not be done at all. Obesity is always dangerous and reducing is always wise if done in the right way. The right way consists in burning up the body fat by providing less than the daily requirements of fuel food and at the same time completely nourishing the body with all other essentials of normal nutrition.

Not the least important of these essentials are the vitamins. Vitamin deficiency is very likely to be present in any case of obesity. It is sure to develop if reduction is tried with foods that do not contain an abundance of vitamins.

A full ration of natural foods should contain all the vitamins we need for normal health. But when we start out with a probability of vitamin deficiency and then cut the total food quantity to one-half or less, even the use of normal natural foods may not be a sufficient safeguard. Hence the wisdom of taking special precautions to secure all the vitamins by the inclusion of foods that are especially rich in them.

Let us again review the vitamins involved, and tell you from which of the reducing foods you may best derive them and from what special sources still greater protection may be secured for those who wish to make assurance doubly sure.

Source of Vitamin B.—The most important and also the most available vitamin is known as vitamin B. It is present in abundance in whole grains but is absent in white flour. By using bran as the bulky element needed to allay hunger and prevent constipation we also get a good source of vitamin B. In leafy green food and to a lesser extent in all fruits and vegetables this vitamin is also found.

The general plan of diet given in later pages is quite as good or even better protection against shortage of this vitamin than is the conventional diet, even though that is consumed in double or triple the quantities of our reducing diet. However, there are two sources of vitamin B known that are especially concentrated. These are yeast and wheat-germ. There are several commercial forms in which yeast is available. The most common is the ordinary yeast cake, now much advertised as a food supplement and as a remedy for constipation. There are also concentrated or extract forms of yeast on the market.

Yeast has not been included in our regular lists of items because it is taken in such small quantities that it is negligible as a source of

calories. Therefore if it were included as one of the units it would have to have other foods with it to make up even one of the hundred calorie units, or a tenth part of the daily diet. Therefore it is mentioned at this point. Its use need not be considered at all, any more than would salt or water, in the matter of figuring calories. It is to be considered chiefly as a source of extra vitamin, and also as an aid towards healthy bowel action, and lastly as containing valuable minerals. But in none of these uses does it affect the reducing problem directly, though it may be a very valuable aid to health-building and the maintenance of vitality while reducing—or at any other time, as a matter of fact.

The use of the live or fermentation-causing yeast is distinct from that of the two extracted forms. The ordinary live yeast such as is used in making bread will continue to grow in the alimentary canal. Yeast is a microscopic plant cell. It feeds on sugar and gives off alcohol and carbon dioxide gas. The alcohol is negligible in amount but the gas formed is considerable. This gas generated in the contents of the alimentary canal has a lightening or leavening effect exactly as it does in dough or batter. This increases the bulk and stimulates more rapid movement of the contents; hence the mechanical effect of relieving constipation. Whether this leavening will prove a desirable condition depends upon the individual and perhaps too upon the frequency and amount of yeast used. In many cases the benefits are obvious, in others the gas cannot be handled so well. Hence the use or nonuse of such fresh yeast must rest on personal experience. But in any case it is in all respects compatible with the idea of the reducing diet.

Some prepared yeasts are not alive and do not grow or generate gas. Their only effect on constipation is that of better nutrition of the intestine itself, or perhaps a direct chemical stimulation from the vitamin or salts.

The use of yeast as an additional source of vitamin, as distinguished from its use to relieve constipation, would seem on the basis of such evidence as is now available to be a good thing. Many experiments on both men and animals show that such additional vitamin increases the white blood corpuscles and builds general vitality and resistance against disease.

Further Sources of Vitamin B.—Wheat-germ rivals yeast as a source of vitamin B. There is some distinction, since vitamin B is now divided into two components, one of which prevents pellagra and the other

beri-beri. The wheat germ is better for the former and the yeast for the latter, but for reducing either or both products are good.

Any whole wheat product contains wheat-germ, but only to the extent of about 2 per cent. Therefore the separated wheat-germ, which is now being put on the market would be a valuable addition to the reducing diet giving the wheat vitamins in much more concentrated form and hence with much less calories.

If wheat-germ is available it would be well to use it to replace part of the cereal servings. The most effective way is to use it uncooked, since the vitamin is partly destroyed by cooking. A couple of tablespoons of the raw germ sprinkled over a dish of any ordinary cereal would greatly enrich the vitamin content of the diet.

Sources of Vitamin C.—Vitamin C is the vitamin that prevents scurvy, the disease that sailors and explorers suffer from when denied fresh foods. The most concentrated source is the citrus fruits, now used the world over as a protective food, especially in infant feeding. Of all the mono-diets (diets consisting of one food only) orange juice stands higher than any other except milk. A combination of citrus fruit juice and milk, particularly recommended when certain symptoms develop on the milk diet, also seems to have great possibilities.

In the Physical Culture Food Research laboratory it was shown that rats could live for a long time on oranges alone while steadily losing weight, and yet retain remarkable vitality. This is the more remarkable since oranges would seem about the last food one would think of as a diet for rats.

We therefore give oranges and similar fruit (including the tomato) a prominent place in our reducing diet, insisting on one daily unit from this group of vitamin C bearers and admitting the permissibility in some cases of even more. There is no extracted or concentrated form of this vitamin known that is any better than the products recommended in our regular schedule.

Vitamin E.—A third vitamin to be noted is vitamin E, known also as the fertility or reproductive vitamin. Wheat-germ already recommended for vitamin B is also the richest known source of vitamin E.

The subject of vitamin E bears upon obesity and reduction because obesity is often accompanied by sexual failure. We hardly need look for any special cause of this other than the fact that obesity results from abnormal nutrition, and an oversupply of fuel and an undersupply of any or all vital elements.

The claim that improper methods of reduction may result in sterility

has frightened certain persons. That vitamin or mineral starvation may cause sexual sterility is well enough known. And the prevention of this outcome is in the avoidance of a deficient diet. Reducing the physical culture way on vital foods is not productive of sterility but is the best way we know to prevent it or cure it.

Vitamins A and D.—Lastly on our vitamin list we may consider the fat-soluble vitamins, or vitamin A and vitamin D. The application to reducing is peculiar because of the association of these vitamins with fat. But the presence of fat in the body is no proof that there are enough of these vitamins because they are not associated with all fats but only with certain fats.

The fat of milk, whether in the milk, in cream, in cheese or as nearly pure fat in butter, is the most common source of the fat-soluble vitamin A. Therefore if at any time you yield to the temptation to eat fat, take it if possible in the form of butter. But even the free use of butter can readily upset reducing plans. A man hungering for fat may eat a quarter of a pound of butter at a meal, and this will give practically as high a calory value as all our day's list of ten items together; all of this entirely aside from dangerous unbalancing of the diet.

There is one item of food in common use that is a better source of the fat-soluble vitamins than butter, and that is the yolk of eggs. And the whole egg is also valuable for other elements needed in our diet, including protein, minerals and other vitamins. Moreover the egg as a whole has only 11 per cent. of pure fat as against 85 per cent. for butter. Hence we should include some eggs in a reducing diet, but exclude the fat of milk, using skim or buttermilk and cottage cheese but avoiding whole milk, cream and ordinary cheese and butter.

There is also a good source of the fat-soluble vitamin A in excellent reducing foods in the form of the green leafy vegetables. This vitamin in lesser amounts is also found in fruits and vegetables, especially carrots and tomatoes.

The richest natural source of the other fat soluble vitamin D is cod liver oil. The virtue of cod liver oil does not rest in the fact that it is oil or even fish oil, but in the fact that it is oil from a liver. The liver seems to be the body's storehouse of these highly potent substances. Hence the suggestion that any animal liver may be a food of special merit. There is much evidence that this is true and some remarkable cures of bone diseases and also anemia are being reported from diets in which liver is the distinctive element. We therefore list

liver as a food that might be wisely incorporated in a reducing diet. It happens also to be one of the least fattening of meat products.

One more point to consider is that vitamin D, a deficiency of which plays such havoc in human life, especially in the lives of babies and children, is absorbed not only from food but also from sunlight.

Therefore the reducer does not need to consider cod liver oil or any other food source of vitamin D if he is in position to indulge in sun-bathing, either with the natural sunlight or the modern sun lamp.

The nature and bodily use of the various nutritive minerals does not need to be considered in detail here. They have been thoroughly discussed in the chapter on minerals in another part of this volume.

Mineral deficiency and resultant loss of vitality and susceptibility to disease is very likely to occur from long continued reduction with improper diets. The reason for this has already been mentioned but will bear repetition. The reducing diet is only a light diet, usually about half the normal amount of total food. But the mineral needs of the body are not decreased by reducing. Hence the reducing diet with but half the amount of total food needs to be about twice as rich in minerals as the normal diet or mineral deficiency will result.

The fuel elements form by far the larger portion of all food. Fat, sugar and starch are pure fuels. Many ordinary foodstuffs like grains or fruits run 90 per cent. or more of fuel elements. All of these foods, however, except a few highly refined foods like fat, sugar and white flour, carry some minerals which contribute to the general supply of the body along with the more special mineral foods like milk, leafy vegetables, etc.

But the reducing body is getting much of its fuel supply from the stored body fat. That body fat carries no minerals. So one living on his own fat is living on a mineral deficient diet. And if the process is prolonged exceptionally rich mineral foods must be used to make up the deficiency.

To make the problem still more serious we are generally confronted with a condition of mineral deficiency and acidosis to start with. Fat people are usually lovers of the fattening foods which generally are poor in minerals. So in proper reduction there is often a correction of mineral deficiency and of lack of sufficient alkalinity that is required as well as the problem of preventing an increase of such conditions.

Controlling Hunger During Reduction.—Fat people like to eat, or they wouldn't be fat. They originally have fine digestions and fine appetites. They form the habit of overeating usually in youth.

Greater muscular activity may for a time burn up the extra food. Then as they get older they take a desk job instead of a job of manual labor, or they drop their exercises and sports, and yet their good appetite stays with them and they continue to eat heartily. As a result they take on fat. As they continue to add fat, physical exercise becomes more burdensome and so they avoid activity and the fat continues to accumulate.

One of the illusions of fat people is that they eat less than other people. It is, of course, true that a fat man who takes no exercise may eat less than a very active slender man. But the notion that he eats materially less than a man of the same muscle development and habits is an illusion. This statement is absolutely true if we include as exercise the action of the heart and lungs. Genuine cases of unusually low food demands are merely cases of slow pulse and resulting slow breathing. Individuals vary in this capacity as in everything else.

But no matter how you explain it, the fact remains that the fat man has been eating too much while he accumulated his fat. That is, he has been eating more than actually needed. These habits of eating have fastened themselves upon him, both as to food quality and food quantity. He will have to change those habits or stay fat. Trying to defy the laws of Nature and get rid of the fat by a miracle won't solve the problem. The fat man must make up his mind that he is going to change his eating habits.

That means a struggle with the power of habit, and a wrestling match with one's habitual appetite. Yet the lure of appetite need not be as irresistible in reality as it may seem in prospect. There are certain ways of forestalling it.

In the first place the scientific investigation of the symptom we call hunger shows us that immediate hunger pangs come from the mechanical movements of an empty stomach. Experience in fasting has repeatedly demonstrated that these hunger pangs are not as dreadful things as some persons believe. Moreover they are temporary and are always more acute during the first three days of a fast than they are later in the same fast. In a long fast the stomach accommodates itself to the condition of being empty and ceases these movements that we recognize as hunger.

There is a secondary hunger that develops later in fasting, and which might be considered much more serious. This real hunger, as distinguished from the mere symptom of the empty stomach, is the call of the system for food elements that are actually needed to sustain life.

The coming of this secondary and final hunger is well recognized by the expert in fasting and is the sign to him that the body has used up its surplus store of food elements and must now be fed again to prevent the consumption of the vital tissues of the body—for that is not fasting but starvation.

In the proper reducing diet use is made of both of the above principles but in a different way than in fasting. With a reducing diet we keep down the immediate hunger symptoms by using as bulky a diet as possible so that the stomach does not get much more empty than on ordinary concentrated fattening food. We also protect against the final symptoms of hunger which are evidence of starvation for one or more essential elements by supplying the body with those elements.

As long as there is fat on the body to be consumed, obviously there can be no real call for fat in the food, since the blood can readily pick up fat from the deposits. Hence any call of the appetite for fat is mere habit call for the taste of fat and is psychological, not physiological. It can be very largely appeased by the use of mineral oil, which tastes like fat but isn't fat.

We should note at this point that one reason that some fat people have such a hard time controlling their appetite is that their food is badly selected and lacks elements which the body really needs. The animal in his natural habitations and on his natural diet has remarkable powers of selecting his food according to his needs. This gift man also has instinctively, but partially loses under artificial conditions and with artificial and highly flavored and disguised foods. So he confuses any call from the system for any element with a general call for food, and therefore even if he is starving for some one food element the result is merely a vague appetite for food. Hence he eats what is handy or what he has been eating by habit, with the result of adding to his obesity. Such an individual is actually starving while he is feasting and is ruining his health both by food deficiencies and by food excesses.

With a scientific reducing diet all this is avoided; by replenishing the supply of missing elements he satisfies the real hunger calls. This means that in time he can learn to control his habitual appetite and maintain his body weight in the future with ease and comfort.

But more immediately he has the question of the bulk of food to consider. He must check these hunger growls in the stomach. Further than this, he must provide some residue in the large bowel to make evacuation easy and avoid the evils of constipation.

For this reason bran is a very important item in the reducing diet.

thought was given to it. Today the game is played all over the country, and is one of the leading sports at many of the great colleges.

Unlike many of the other sports, basket ball does not tend to develop any particular part of the body, but acts as a general up-builder. The arms are exercised by throwing the ball, and passing from team-mate tc team-mate; the legs are developed by their continuous action in running up and down the court, and the condition of the chest and lungs is improved by the active work required of them and the free deep breathing induced by the game.

A large part of the game, in fact, the success of a team, depends upon the brainy work of the players, who should take advantage of every opportunity presented to cage the ball. In this manner the game offers a certain degree of mental training, as does boxing and many other sports.

Accuracy is one of the requisites of a player, and the eyes receive good training in the basket shooting practice. Many a man sound in mind and body, but with poor eyesight, has been benefited to a great extent by this practice.

The game is played by ten men, five on each side, and the time of play is divided into two periods of twenty minutes each, with a rest of fifteen minutes between both halves. During the twenty minutes' play in both halves, the players are allowed but three rests of five minutes each, if necessary, so that they are practically on the go all of the time.

Two baskets and a ball make up the paraphernalia of the game. The ball is a little larger than a soccer football, and weighs more. The idea is to cage the ball in the baskets, which are suspended from the ceiling or are placed on stands.

For the gymnasium, there is no better game. At the same time, when played in the gymnasium, there is the disadvantage of the fact that it is played indoors, and for this reason the open-air basket ball courts should be encouraged as much as possible. Open-air playgrounds in our cities sometimes have arrangements for basket ball, the "baskets" fastened to posts instead of to the walls as is common in most gymnasiums. One may enjoy it as much in the gymnasium, and may develop nearly as much endurance and speed, but the constitutional benefits are much greater when played out-of-doors. While considered a winter game, from the fact that it is usually played under a roof, there is no reason why it should not become equally popular as a summer game when played out-of-doors.

Bathing.—See *Swimming.*

Bicycling.—See *Cycling.*

Boating.—See *Canoeing, Ice-Boating, Rowing* and *Yachting.*

Bowling.—Bowling is a popular sport, because of its attractiveness to both beginners and experts. As an exercise it is fair, though one-sided from the fact that one uses only the one arm with which he has become most expert. From the standpoint of exercise it would be far better to learn to use both arms equally well. It would sometimes add to the interest of the game for a couple of right-handed players to match each other in a game with only the left hands used. Bowling is fairly good for the back.

Occasionally an enthusiast of means constructs an open-air bowling alley, though sheltered from the rains by a roof, on the grounds of his country home, and under such circumstances the game is to be recommended. Unfortunately, however, it is usually played in cities in public places, in low-ceilinged, unventilated quarters, and in an atmosphere dense with tobacco smoke. For these reasons a more enlightened public sentiment should lead to bowling in the open air. The old game of *bowling on the green* was well worth while.

Boxing.—Boxing is a most valuable exercise, not only for building strength and endurance, but for developing all of those qualities which go together in the making of splendid, virile manhood. It trains not only the body but the spirit as well, develops courage, moral and physical stamina and teaches rigid self-control in all emergencies.

The boxing game dates back to the beginning of history, though it has not always been the sport that it is now, in its modern refined interpretation. Among the ancients a boxing match was sometimes not much less serious than other gladiatorial combats in which the sword was used. In place of the padded mitts of our own time, commonly called boxing "gloves," the cestus was used. The hands were covered by strong leather thongs, and sometimes these were reenforced with bands of iron, the fist of the boxer being made so formidable in this way that a blow might mean death. In any case the result was a terrible mutilation and permanent disfigurement.

Modern boxing, however, takes on the character of exercise rather than of real fighting, for it is seldom that a boxer who is sufficiently well trained is truly injured. If boxers are fairly well matched in speed and skill, then in many cases the outcome of the contest will depend chiefly upon their stamina and endurance. Boxing is now a "sport" in the true sense of the word; it is the "play" form of fighting,

and while it prepares one for competent self-defence in time of emergency, it also makes him stronger and more vital. It trains the eye, makes one more alert, gives him more confidence, develops decision, perseverance and firmness. In short, it is a splendid exercise for both the moral and physical education of any young man, developing the qualities which he will need throughout life for attaining success in almost any field of endeavor.

Those who talk of the inevitable brutality of the boxing game, probably have in mind the old time "prize-fighting" days when bare fists were used and the pugilist could do almost anything he chose to his antagonist. In boxing today there is a strict set of rules which forbid hitting only in certain parts of the body, and there is a referee in the ring to see that the contestants abide by these rules or be disqualified. Well-padded gloves are worn on the hands, and matchmakers and promoters everywhere endeavor to match boxers who weigh the very same to a pound, so that they will be evenly matched. Before the contest both boxers are compelled to "weigh in" to see that these conditions are fulfilled. They go through a preparation of training which necessitates strict clean living and

The skilful boxer employs general activity in defense and offense, and does not use energy in blocking or parrying blows by hands or arms. Instead, he should keep his own hands free for continual offense. Modern boxing thus demands a greater degree of active footwork than here indicated.

faithful exercise, putting them in the ring in a splendid physical condition to go through a trying contest, trying chiefly from the standpoint of endurance. It should be said that after boxing at terrific speed for some time the inevitable fatigue of the muscles takes the sting from the blows so that in a long contest one does not hurt the other very much. Even in the beginning of the contest, both are so well trained and hardened that they do not suffer from the blows delivered with these padded gloves.

The physical essentials of the boxer are *strength, speed, stamina* and *endurance.* First of all one should build strength, which later will help in developing endurance and stamina, but while securing strength one should be careful not to become muscle-bound or stiff, or his strength will be of no use. One should exercise in such a manner as to keep his muscles elastic and supple and to develop speed. After this will come the knowledge and skill in boxing.

Perhaps an even more important factor in some cases is learning *how to nurse your strength.* And the secret of this is *relaxation.* There is no need for tenseness of the muscles when sparring for an opening. If one's muscles are so tensed he cannot possibly strike quickly when the opportunity comes, for he must first relax and then contract the striking muscles. If relaxed, the muscles may contract with great vigor at the moment of impact, but the instant the blow has been struck, they should be relaxed again until power is summoned for the next blow.

The left foot and the left hand should be forward. The left toe should point straight at your opponent, and not be turned to the right a little, as it may if one is careless. The left leads are likely to go where the toe points, and if this is not directly toward the other man these leads are likely to miss. The body should be turned with the left side toward antagonist, showing as little front or body surface as possible. Thus there is not so much space exposed to attack. The left knee should be bent slightly, the weight chiefly upon the right leg. The left elbow should be bent, the glove on a level with the shoulder, and ready to be extended quickly for a lead. Both elbows must be well in at the sides, for it is chiefly upon them that one should depend to block body blows.

The right arm should be carried across the body, the elbow close to the right side, the forearm across the solar plexus, and the glove up by the chin. The head should be held well forward, the chin down and inward, almost resting on the chest, and sheltered by the left

shoulder from any wild right swings from opponent. The attitude of the whole body should be loose and relaxed.

Care should be taken not to get both feet together. They should always be about eighteen inches apart, according to height of boxer. A tall man would probably require his feet more than eighteen inches apart, while a short boxer may have a better grip on the floor with his feet about twelve inches apart. It is just a matter of feeling secure and safe on one's feet. If the feet are too close together a blow will easily knock one down like a nine-pin. Try to grip the floor with your feet just as an expert rider grips a horse with his knees. On the other hand, if the feet are spread too far apart a boxer is unable to move about quickly enough to get away from the attack of his opponent.

Canoeing.—To the uninitiated and the overtimid, the canoe is often regarded as treacherous and foolhardy. If the tyro will obey the injunction to attempt no "smart" tricks and use ordinary judgment, with careful following of certain fundamental principles, he will speedily learn to handle a canoe with a fair degree of expedition, comfort and practical safety. Use common sense.

Good exercise is afforded in the use of either the single paddle or the double paddle, the latter being a long oar with a blade at each end so that one may alternately dip on each side of the boat without changing hands. The course of the canoe is not so direct and steady, however, as with the single paddle.

In using the single paddle the blade is rather inward and under the canoe instead of out to the side, as in ordinary rowing, which would turn the direction. To keep the course straight in spite of paddling on the one side, the beginning of the stroke should be slightly inward, finishing up with a slight outward inclination. One should learn to paddle equally well on each side, not only for symmetrical development but also for the greater pleasure.

It may be remarked that after trials of many kinds of making, the canvas canoe has come to be regarded as undoubtedly the best. There is a sheathing of cedar and over this is drawn the canvas. This is treated with waterproofing and then painted in any color or design.

Coasting.—Coasting and tobogganing could be highly recommended for building and maintaining health if only on account of the wholesome pleasure and the outdoor air associated with such sport. The out-of-door life in winter is especially beneficial because the bracing cold has a powerful influence in building resistive vigor, and in

making one hardy and warm blooded. But if the slide down the hill is calculated to set one's blood in active circulation through its joyous thrills, it is only the inducement for climbing the hill. And when one has climbed a long, steep hill dozens of times in an afternoon, not laboriously and slowly, but eagerly and with no thought of fatigue, there's exercise for you. All that may be said of walking can be said for coasting, with considerably more besides. The alternating slide offers just the right amount of relaxation and recuperation between the climbs, so that one can keep it up for hours at a time, hours of profit both from the standpoint of pleasure and health.

Croquet.—Croquet is a lawn game which for several decades enjoyed considerable popularity, though in recent years it has been somewhat neglected for the sake of more energetic pastimes. Long-handled wooden mallets are used for driving large wooden balls through a series of wire arches set in the ground. The game is played on a small court and depends upon skill and delicacy of stroke rather than on strength.

It is an exercise well suited to those who are convalescing from some weakening disease. As an exercise for the healthy man or woman it is so mild as to be worth little. The arm exercise is almost nothing and while there is occasional bending and thereby a little exercise for the back, the chief exercise is that of moving about leisurely upon one's feet. From its mental interest it is an attractive game to some people, and may be recommended because it offers entertainment that will take one into the open air.

Curling.—The Scottish game of "curling" is usually indulged in by the elderly. Curling calls for smooth ice and a spot sheltered from the wind. Unexciting as the game may seem to outsiders, yet experts aver that it is full of moving chances and incidents that make it most interesting. In any event, the sweeping rush of the "stones" and the swish of the brooms are as music in the ears of the confirmed curler.

Cycling.—The bicycle offers a valuable form of recreation and exercise, though it may be said that as an exerciser the wheel is not all that is to be desired. It is of value chiefly as a means of pleasurable outing, frequent trips into the country for the sake of the sunshine and the air, being a matter of easy conveyance. Crowded roads, to be sure, do not conduce to safety or to comfort. The chief service of cycling is in bearing one away from such conditions.

What has been said of ordinary cycling applies in some degree to motorcycling also, despite the lack of use of the large muscles in the

case of motorcycling. In riding for health, one should be content with moderate speed, enjoying the scenery, the sunshine and other things which make bicycle trips worth while The seat should be adjusted so that one may sit erect, and may enjoy comfort even though remaining on the wheel for hours

Discus Throwing.—See *Weight Throwing.*

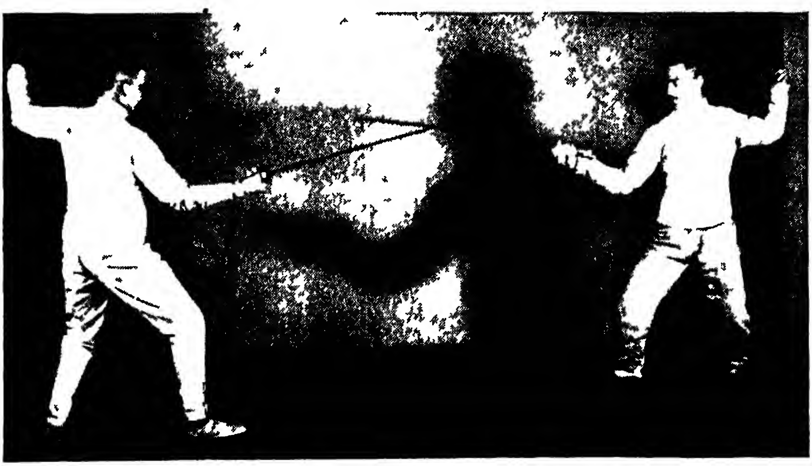
Equestrianism.—See *Horseback Riding.*

Fencing.—Sword play of various kinds has been practiced since the very earliest ages, and as its outgrowth we have our modern fencing The fact that fencing still holds its place in the field of sport is enough to show of how great interest the art is, when so very many other means of exercise are now being practiced.

After the Greeks and Romans introduced sword play, the people of Spain, Italy, France, and later Germany, England and America became enthusiasts and ardent students of fencing.

In olden times much heavier weapons were used, but these have given way to a finer, more tapering blade After the rapier had been used for some time it was replaced by a much lighter weapon This makes possible the parry, feint and lunge, the latter having been discovered by di Grassi, an Italian fencing master of the sixteenth century

There are two schools of fencing, the French and Italian To fence well in accordance with the French school one must acquire great skill, technique, delicacy of touch and the finest foil play possible A



In fencing, it would be of advantage if the hands were used alternately by the fencer so as to attain an equal development of strength of right and left wrist, hand and arm.

good Italian fencer must be a Hercules; for in this school one is taught to overpower one's opponent by strength. Politeness, agility and sensitiveness of touch help make the French fencer skilful. As far as strength is concerned, a woman might develop into the best fencer. Grace, quickness and skill are most required to make a good fencer of the French style.

Some people maintain that fencing is a one-sided exercise. This is not so if the proper positions are held. Notice any fencing master, a man who uses the foil nearly all day, and nowhere will you see a man of better carriage.

In the position of "on guard" the shoulders are at an even height, the left arm is bent as well as the right, the left knee is bent equally with the right knee. When the lunge is executed the left leg receives as much or more exercise than the right, and the left arm is thrown down parallel to the left leg with just as much force as the right arm is extended. As one recovers from the lunge the left knee acts as a hinge and both arms are bent to aid in returning to the "on guard" position. The only difference that can be found in the right and left sides of a fencing master is in the right forearm. The extra weight of the blade and the movements of the muscles of the forearm give added strength to the tissues there.

Fencing requires a great deal of nervous expenditure. The rapid response that one must make to the various attacks of one's opponent and the ready *ripostes* and fresh attacks call for neuro-muscular control. One must quickly judge the weak and strong points of one's opponent and direct attacks and feints accordingly. To be keen and quick in foil play are essentials. A good fencer should make a better business or professional man because of the exercise. The mind receives much work when one is fencing. As soon as one fails to be alert and ever ready with parries the battle is lost.

The fencer's mat is usually about three feet in width and less than twenty feet long. All the work is carried on lengthwise of the mat, never side to side. Stepping off the mat at one side or the other constitutes a foul. As soon as one of the competitors is touched, he should call out to that effect. If a contestant is slow in acknowledging good touches the referee may award a few points to the other contestant. Form counts for a good deal in this form of exercise as in others, and mat etiquette has its points in form for or against a man.

The foil is equipped with a "button," and masks and gloves must be used. Fencers usually also wear padded chest protectors. All

thrusts, parries and movements should be thoroughly practiced and mastered before free fencing is ever attempted.

The different attacks and parries, tierce, carte, seconde, sixte, septime, octave, prime, etc., are so named because of the division of the torso into sections referred to in this way. The parry will be determined by the position of the foils in attack and the point aimed at. In parrying, however, the hilt of the foil is shifted just enough to deflect the thrust, while the point of the foil is held as nearly as possible where it was before, in order that it will be ready for a counterattack.

As an exercise, fencing has many points that strongly recommend it. The movements which it involves are so varied that it calls into play almost every muscle of the body. It also demands a marked degree of mental concentration. Those who are unable to devote their every energy to the occupation that they may have in hand can never hope to become successful fencers—unless, indeed, they find in the sport a means to acquire the complete control of their faculties. This is by no means unusual, and one of the most useful features of fencing is that it develops the mind and the body simultaneously, and tends to produce the all-around development which makes the ideal man or woman.

One of the most marked effects produced by a constant indulgence in fencing, is the remarkable degree of grace of movement it produces in men as well as in women. It is impossible to become an expert fencer unless one possesses, or acquires, a swiftness and certainty of movement, and ability to move in exactly the proper manner at exactly the proper moment, which at times appear truly remarkable. This statement applies more directly to exponents of the French rather than of the Italian school of fencing—although both methods have many strong points, and numerous staunch adherents to advocate them.

Fishing.—Fishing, under many conditions, is a lazy man's sport, though it at least has the advantage of taking one out-of-doors, and in some cases of lung trouble or of nervous weakness, might be valuable just because it is a lazy, restful sort of recreation. From the standpoint of exercise, there are two varieties of fishing which may be recommended, the first of these being deep water fishing from a boat, which may include a great deal of rowing, and which means a stubborn resistance upon the part of big fish. This will apply both to salt water fishing and that on the inland lakes provided with

pickerel, pike and bass. A second form of fishing which provides good exercise is trout fishing in small, clear brooks which require that one keep moving up or down the stream almost continuously in order to get a catch. Scrambling through dense brush all day long, up and down the bank of a stream, under such conditions, or even wading down the stream, which is usually better, will give one that appetite and that ability to sleep which prove the value of any true recreation.

Football.—In speaking of football, no matter which form of game is referred to, one is safe in saying that it is one of the greatest, most vigorous and most fascinating of all team games, and the popularity of the different phases of football in those localities where they are known is evidence of the pleasure found in such stirring games. As a matter of fact, football is played all over the world, from Europe and North America to Australia and New Zealand.

Football is not a game for weaklings, either physical or moral. The man who is not heavy enough or strong enough to endure the taxing demands of this game should seek some form of exercise for which he is fitted. The man who does not have the moral stamina to control his appetites and his temper ought to take up fasting instead of athletics. Football is a game for men who have strong bodies, clear minds, and clean morals, and who desire a thrilling sport which will tend to develop sturdy manhood.

The right kind of a player, one who goes into the game to do his best, win or lose, who strives in every way to bring honor to his team and true development to himself, may have a few bruises, and sprains, or even a broken bone among his fond recollections; but he will also enjoy satisfying memories of happy experiences on the athletic field. He will appreciate the fact that there he received most excellent training for use in his honest struggles for true success. Football helps to develop a strong, healthy body, a quick, active mind, and a character of courage, fairness and self-control.

There are three important phases of football, though two of these are really modifications of each other. On the one hand we have "Soccer," or Association football, the straight kicking game, and on the other we have the two divisions of Rugby football. The original straight Rugby football is played extensively in the British Isles and in most of the British Colonies, though very little in the United States, whereas the great national autumn game in the latter country is what may be termed Modified Rugby, though it is now so different from

the parent game that the term Rugby is almost never applied to it. It is sometimes referred to as "Intercollegiate" football, to distinguish it from the other phases of the game, but when the simple term "football" is used in America, this is the variety understood.

Soccer.—The Association football, more commonly known as "Soccer," is the same in all countries, and is very, very far from the nature and style of play of Rugby, and especially from that of the American game. Association football is really a true *football* game, inasmuch as the ball, a perfectly round one, is handled almost entirely by the feet, kicking or dribbling. It cannot be carried; cannot even be touched by the hands or arms, except by the goal-keepers, though it may be bunted with the head or any other part of the body, exclusive of the upper limbs. It is a kicking game throughout, and it not infrequently happens that when a player is unable to reach the ball with his feet, he drives the toe of his boot instead into the shin of a more successful, though in this respect unfortunate, opponent. What is known as Gaelic football is very popular in Ireland, and also among the foreign-born Celtic population in America. It is a variation of its own, though similar in many respects to the Association game.

In Rugby, however, while the ultimate aim of each side is to advance the ball to the goal of the opposition, yet it may not only be kicked, but may be carried, or even thrown in a backward direction from one member of the team to another, in order that it may be carried farther forward, it being left to the opposing team to stop the ball or the man carrying it if they can. And this, in the main, is the plan of American football, with some notable differences in the rules and style of play. The ball in both cases is oval in character.

There are scrummages in both games, although the "scrimmage" as Americans know it, and as they term it, is radically different in formation and action from that of the Rugby game. There are similar rules in regard to "off-side" play, with penalization for offences in this respect. There is in both games the passing back of the ball from the scrummage, to be put in play by the backs, these passing it to each other as the action of the play may demand. After this either kicking or carrying the ball is in order.

American, or Intercollegiate.—A team in this game numbers eleven players, while in Rugby there are fifteen, though it is sometimes played with thirteen on a side. Rugby is the more open game of the two, and, possibly, the faster. In the Intercollegiate style of play there is a

rather close formation of the entire team, with a great deal of man to man resistance when the ball is put into action. A few years ago the game was almost entirely a pushing, straining series of so-called "mass-plays," but on account of the frequent injuries due to this style of play there is again a tendency to more open play with more frequent kicking and passing of the ball, or in other words, a partial return to some of the more distinctive elements of Rugby.

The American intercollegiate game is often said to be dangerous. It is certainly true that it is rough, but for those who know it the game has a certain charm and fascination that is not associated with any game less violent.

It offers many of the same advantages that wrestling affords for physical development, though it is more violent and apparently of greater interest from the fact that the contest is not merely between two men but between two diminutive armies, each, however, working with much of the same coordination and unity of action with which a single individual would employ the various members of his own body.

The action is as nearly continuous as one could wish, the brief pauses between the scrimmages merely affording that momentary relaxation which enables the contestants to endure the tremendous demands upon their strength.

The formation of a football "eleven" in the American game, when engaged in offensive play, consists of a "line" of seven men, for protecting the "backs" while the ball is put into play, and behind this line a "quarter-back," two "half-backs," and one "full-back." The "line," consists of the "center," who holds the ball and snaps it back when ready for the play, two "guards," one on each side of "center," two "tackles" next and outside, two "ends." Everything depends upon team play, and the various members of the team must work as a unit. The line and the backs may shift to many positions to advance the ball. It would be almost useless to take up in detail the rules and methods of play, inasmuch as the rules are changed considerably each year by an Intercollegiate Rules Committee. The game is still in a state of transition and evolution and will probably be modified a great deal more for years to come.

Rugby.—In the disposition of a Rugby team, there are usually eight of the men detailed for duty in the scrummage. This varies sometimes, as in the case of the New Zealand teams, in which only seven men are used for this purpose. The scrummage is also called the

"pack," a term which is also applied to the act of lining up in place for a scrummage. It is the business of the scrum men to hold the opposing pack until the ball has been "heeled out" and put into play by the backs, after which they break up and render any further service possible in any part of the field. They are also known as "forwards," in contrast to the names of the half-backs and the others. Of half-backs there are two, one of whom, known as the "scrum-half," occupies a position which has some relation to the duties of the quarter-back in the American game. The scrum-half, just back of the pack, gathers the ball as it is heeled out of the scrummage, and transfers it back to the other half, who then will probably determine the character of the play from that time on. In most cases he will find occasion, either at once, or after a short run, to pass the ball back to one of the "three-quarters," of whom there are four, forming a line across the field in the rear of the half-backs. Back of the three-quarters, and completing the membership of the team, is the "full-back," whose especial and sacred duty it is to defend his goal against attack, though also to render any other service that may come within his power. The most active and conspicuous members, therefore, are usually the half-backs and three-quarter-backs.

One may be sure that after a ball is heeled out of the scrummage and put into action by the backs, the opposition are not idle, for it is as much their purpose to stop the advance of the ball as it is the desire of the possessors to accomplish that result. Whenever possible, the ball is intercepted by the enemy during a pass, but this is seldom, and tackling must be resorted to. But just as one tackles the man carrying the ball, or the instant before, he will contrive if possible to pass it back to the next three-quarter behind him, who will in turn endeavor to carry it forward, pass it back yet again, or perhaps, punt it down the field, as the circumstances demand. The statement that it is passed back does not mean directly back, but more usually in a sideways direction, though slightly backward, and never in a forward direction.

Such perfection in team work is accomplished that the runner does not need to turn to see his team-mates behind him when compelled to pass the ball to them. They will see to it that they are there, and he takes it for granted. Furthermore, he does not pass the ball directly to the point at which they are located at the instant, but usually a couple of yards in advance of that point, so that they can catch it while running at full speed and lose no time. Passes are usually

made with both hands together, a one-handed pass being unreliable. Great precision and skill in passing is acquired, and it is a sort of unwritten rule that the ball is to be passed and caught while in full speed. The manner of advancing down a field in the face of the opposition is partly suggested by the tactics used in basket ball in America. Strategy goes a long way in Rugby, as in all sports.

The full-back, who must be a strong kicker, frequently has occasion to punt and thus place his goal out of danger for the moment. When the ball goes "out of bounds," as we express it in America, it is said to be "in touch," and the play is stopped for the moment, being presently thrown in by a member of the other side. This is called the "line-out," the players taking positions opposite the point at which the ball went in touch, and one player throwing it in.

Speed and skill are at a premium in Rugby, while in the American version of football weight and strength count for a great deal. The schoolboy who wishes to take up this game should first undergo a preparation of special training by systematic exercise in order that he may harden and strengthen his body for the tough usage which it will receive in this rigorous though splendid game.

Golf.—It is said that in order to make the rounds of the holes of a golf link, one has to walk about ten miles, this distance, of course, including the deviations due to badly driven balls. While the player may not always be called upon to undertake a journey of this length, yet walking and golfing are inseparable, which accounts for much of the latter's healthfulness. If a sport leads one unconsciously to take a good deal of fine exercise, and that too without feeling fatigue during the effort, you may depend upon it that it is of an ideal nature in an athletic sense. And this golf does. If one feels tired it is only *after* the game, and not while one takes part in it. The sleep which follows is that which waits only on him who has honestly and healthfully earned it, and such sleep, by the way, is a sure sign that the sleeper enjoys a high degree of vitality. Broken rest is due to causes which tend to lower one's vitality. Insomnia is nothing more or less than a manifestation of a nervous condition produced by a disturbance of one's mental and physical poise, or in other words, an upsetting of normal vitality. Golf is a great game to abolish such a condition. One never ceases to learn the game, which is the same thing as saying that it makes a continual demand on one's mentality. It offers so many developments undreamed of by the novice that one may play for years and learn something, on every occasion. The unexpected

situations which it creates and the unlooked for eventualities that it presents keep the mind pleasantly busy, and here again we have another reason of its mental healthfulness and why it adds to one's vitality. To properly "address" one's self to the ball, which means that the player must place himself in the recognized position to strike the ball, to know how and when, and why to use the cleek, the brassie, or the lofterer; the mashie, niblick, driver, or putter; to learn how to "slice" or "pull," to make due allowances for wind strength, to avoid the perils of bunkers or hazards in general, to know how to "honor" with credit and skill—these are but a few of the things that go to the making of a skilful player and, incidentally, add to his vitality while he is learning them.

Then there is the actual exercise which is demanded. To the unknowing, it may seem an easy matter to strike a ball with a club especially made for that purpose. As a matter of fact, the reverse is the case. To learn properly to handle a club, that is to say, to "grip" it, is in itself a portion of golf technique, which calls for careful training on the part of the tyro. Then, again, each club is only suited for a given purpose and must be used in a special way. At present, what is known as the overlapping grip seems to be the favorite with professionals and advanced amateurs. With this grip, the fingers of the right hand are placed below the left on the handle of the club. By this means the amount of work and responsibility of each hand is properly proportioned; for where it is otherwise, a stroke is apt to go wrong. Sometimes it is necessary that the right hand shall be the controlling factor and sometimes the left, according to the nature of the stroke. This is instanced as an illustrative fact of the technical difficulties which surround golf and make it the game which it is.

In making a stroke of almost any kind, the amount of muscle effort that is used, together with the mental concentration, are far more than the outsider realizes. Suppose that the player is making his drive from the tee, which, as the reader probably knows, is a tiny eminence made of sand. The object of the drive is to send the ball in the direction of the nearest hole and in order to do this the player must not only put a good deal of force in the blow, but he must also see to it that he so hits the ball that it flies in a straight line. In order to do this, the club must describe a swing downwards and onwards, so as to strike the ball from the tee, and then, without ceasing its forward motion, continue on and away to the left. There must be no break in this motion. The point is, that this long, clean, slashing stroke,

with muscle and mind behind it, constitutes a form of athletic movement of the best and, as a consequence, assists in the making of vitality. What applies to the drive, applies almost equally to other strokes, each of which calls for a vigorous movement.

Aside from the great constitutional benefits of the game due to the walking and outdoor air, these various movements of the arms in swinging the clubs afford splendid exercise for the muscles of the chest and shoulders, and also, to a lesser degree for the back and sides. There is no game that can be more highly recommended, and especially for those who have passed the age at which violent exercises are attractive.

Hammer Throwing.—See *Weight Throwing.*

Handball.—Handball is one of the fastest of all games, when played with energy, and offers such a combination of exercise that it is valuable for every part of the body. In its activity and benefits it may be compared to basket ball, though the general scheme of play is entirely different. It requires the use of both arms at different times, great activity of the legs, and vigorous use of the back muscles when stooping for the low balls. It is a game that may be played either indoors or outdoors, though most frequently and most advantageously outdoors. Wherever a brick wall or any other smooth wall may be found, with level ground in front, a handball court may be improvised. In gymnasiums, four-wall courts also are used.

The hand, bare or gloved, is used to strike the ball, but instead of striking it over a net, as in tennis, it is batted against the wall, bounding back with great speed. Players on the two sides must strike it alternately, keeping it going, and to miss is to yield a point to the other side. It must be struck on the fly or on the first bounce with one hand only, and never caught or held.

Lay a book on the table. Open it in the middle till the cover you have in your right hand is at right angles to the other cover—there you have a model of a front wall and floor of a handball court. A line across the floor a third of the way between the wall and the back line is all the marking there is to the court. This is the "ace-" or service-line.

The standard one-wall court is 20 feet in width by 34 feet in length, with a back wall 16 feet in height. Four-wall courts must be 22 feet in width, 46 feet in length, and 22 feet in height, and have four walls and a ceiling.

For practical illustration, let us say that A and B are about to begin

a game. They toss a coin for serve and A wins. In handball only the server can score points; he continues to serve until he is put out, *i.e.,* fails to return a ball properly. A, the server, stands back of the "ace-" or service-line, anywhere he pleases, drops the ball with one hand and strikes it against the wall. He has two tries to make it fall into the court between the service-line and the back-line. If he fails in both attempts he ceases to be the server and changes places with his opponent.

If he does make a proper serve and the other man returns the ball to the wall in such way that the server fails to get it back, he is "put out" and has to give up the serve to the other man. In that case no one will have scored a point—for only the server can score. The man who succeeds in the scoring of twenty-one points first wins the game.

The whole object, then, is to become the server and keep the serve. And naturally the serve in handball, as in tennis, is a very great advantage. There are men, not particularly skilful in the other departments of the game, who have acquired great skill in delivering a serve so difficult to handle that they can win from men who really know much more about the game as a whole than they do. And herein consists one of the attractive features of the game and one which makes it so well adapted to men of all ages—the fact that head work is worth almost any amount of strength and agility with judgment lacking.

As in tennis, there may be anywhere from five to fifteen plays in a rally before the point is finally decided. Back and forth the players go, first one driving the ball high up on the wall to force his adversary back in the court, then perhaps shooting it low on the wall in an attempt to make a "kill." Continuously the eyes of both players follow the ball, and, with an intuitive sense where A is going to drive it, B manages to make his return and keep the rally going until he himself can make a try for a "kill." That is the give and take of the game; skill matched against skill a dozen times, perhaps, in the deciding of one point—at the play's end the satisfaction of one of the players in having sent back the ball in such a way that his antagonist couldn't handle it.

The "doubles game" is much less strenuous, and as it gives four people a chance to use the court instead of two, is more generally played. Handball doubles are played similar to tennis doubles. A and B play against C and D. The former are the servers, the latter receive.

A goes in and serves; if he is put out, B gets a serve. If B is put out, too, the sides change places and C and D each get a serve.

In a properly played game of handball doubles, A and B are supposed to divide the court with an imaginary line and each *covers his own half*. Utter confusion of the game follows the attempt of one partner to encroach on the other's territory. Once in a while, when, perhaps, A has been forced into the back court, it may save the point for B to rush across and take a return that his partner seems too far back to handle. But nine times in ten unless a "kill" can be made, the result will be confusion and eventual loss of the point. If players could be made to realize this one thing, the standard of all the handball doubles played would be improved.

There are certain general principles to be observed by beginners which will raise the efficiency of one's game in a striking degree. In the very first place, cultivate a "loose-handed" way of hitting the ball —the arm should never be rigid and should snap the ball rather like a willow withe than strike it stiffly, as with a baseball bat. The stroke of some of the best players is almost as though they caught and threw the ball each time. It is almost impossible to have the arm too much relaxed. Keep the hand open, the wrist swinging free. Hit the ball with the upper part of the palm, just where the fingers begin. In delicate shots use the fingers freely. It is wonderful what accuracy their careful manipulation will give.

So much for the way of hitting the ball; now as to the question of your position. And right here is where handball differs essentially from most other games. In golf or in tennis, for instance, unless you adopt the *right way* of hitting the ball you can never make much progress. In handball it is different. There simply is no right way or wrong way. The only rule to follow is to find out which style suits you best and then to develop that. If you have started playing overhand or running back and taking everything underhand, and it comes natural to you, stick to that.

Too much attention can hardly be given to the use of the left hand. In doubles where you only have to cover half the court you can scrape along pretty well with your right only, but in singles it is indispensable that your left hand should be good enough not only for defensive work but to earn points with. Use your left hand continually in practice games when you are just knocking the ball around the court. The ability to place the ball with the left will undermine the strength of your opponent's game to a greater extent than you might imagine.

An excellent outdoor court may be arranged by using an even, unwindowed wall of a barn or other building, and making a level floor of smooth lumber, or as a last resort, of closely packed and well-rolled clay, although, of course, wet weather will play havoc with the court last mentioned. Unquestionably side walls will improve any court by preventing the ball from going out of bounds. Given a hard, even surface of wall and floor of court, you need do no more than mark the service-line at the proper point of one-third of the distance from the wall and the back-line of court. Thus, if your court is twenty-one feet deep, the line will be seven feet from wall. An indoor court may be arranged even more easily than an outdoor court by following these plans.

The regulation handball measures one and seven-eighths inches and weighs two and three-tenths ounces, but a ball much lighter in weight and even a trifle larger in size may be used. In fact, many claim that the lighter ball involves playing a more strenuous and active game than does a ball of greater weight.

Hand Wrestling.—This is a very interesting form of exercise, and one which affords a far greater amount of vigorous resistance than would appear in merely looking at it for the first time. Between two strong and well built contestants it becomes a truly strenuous pastime, although it must be said that success depends almost as much upon skill as upon strength.

The two competitors simply grasp hands, as in a handshake, but well poised upon their feet, and each with the right foot placed just outside of the right foot of the other. Before commencing the bout, the hands should be midway between, or just over the position of the feet. When ready, each tries to dislodge the other from his position, by pushing, pulling or jerking sidewise. To move either foot, or to place a hand, knee or any other part of the body upon the floor, will constitute a fall. Sometimes, when opponent is pushing hard, by suddenly releasing resistance one may contrive that his own momentum shall throw him off his balance, and the same in pulling.

There is one important point to be considered in hand wrestling, namely, that one should engage in left handed bouts just as frequently as in right handed, in order that both sides of the body may be developed equally. A bout is continued until either one or the other loses his balance, moves his feet, or touches either the floor or his opponent with any other part of his body. In addition to providing active exercise hand wrestling is a pleasant recreation that

can be indulged in anywhere, from the parlor to the lawn, and is suited to competition between those of opposite sex. It frequently happens that a woman with a little practice and skill can overcome the superior weight and strength of a less skilled but powerful masculine adversary.

Hares and Hounds.—See *Running*.

Hockey.—*Ice Hockey* is naturally confined to localities that have cold weather, and where skating can be enjoyed. It can be played on pond, lake, or river, or indoors on artificial ice—in fact, in any place where ice skates can be used. A team is composed of seven men, who are equipped with skates, and with long crooked sticks like "shinney" sticks. These are, however, broader at the end than the sticks used in the more simple parent game.

Each side chooses a goal, which is made up of netting, held by uprights, and the idea is to send a rubber disc called a "pluck" into one of these goals. The game is played in two halves of from fifteen to thirty minutes, and the team scoring the most at the end of the game is adjudged the winner of the contest. The men are on the go continually, and except for occasional pauses are playing at all times.

To become a first-class hockey player it is necessary to be a first-class skater, but this comes in time, and is acquired with practice. By the beginner, hockey should be taken as a form of exercise, and one must not try to be an expert in a short time. Playing for amusement is always the best policy.

Skating outdoors and playing hockey brings a ruddy glow to the skin, and even if not practiced for more than twenty or thirty minutes a day will bring results that will surprise even the most pessimistic.

Shinney or Field Hockey.—This is virtually the game of hockey played upon land instead of upon the ice, the original form of the game. A bent stick is used not unlike the hockey stick, though the game has never been developed to the same extent as the great game on the ice. It is of a more informal sort, usually played by boys, and not uncommonly in the streets. It is still played considerably by schoolboys throughout the middle west of the United States. There is no special rule as to the number of players, for any number can pair off and play it. A small hard rubber ball is the object of play, though sometimes a small block of wood will answer the purpose. It is a lively, scuffling, racing game, as one might expect, though not so fast or scientific as hockey on the ice.

Horseback Riding.—Horseback riding is a splendid pastime not only for taking one out in the open air, but for the sake of the muscular exercise which it involves. Men of the saddle are nearly always vigorous physically as the result of this one form of exercise, except, as in the case of some of the cowboys of the West, when the indulgence in alcoholic beverages and other deleterious habits offset the good accomplished by their riding. Arabs, Cossacks, Indians and famous riders in all parts of the world are invariably men of magnificent physical resources.

It is true that everyone is not in a position to adopt this form of exercise, but it is so beneficial that one should not neglect the opportunity. Any horse that is suited to the saddle should be used in that way as much as possible, rather than merely driven around with a buggy. Even the walk of a good horse, when you are astride, is better than sitting in a carriage. "Single-footing" is a very pleasant exercise if one has the right kind of an animal, but a good, comfortable gallop is the very best of all. It cannot fail to strengthen the legs, the back and the abdominal muscles. To ride well, one should learn to allow his body to conform properly to the motion of the horse, rather than trying to resist it. In the gallop, instead of leaning awkwardly forward and being jolted a few inches off the seat with every stride, one should sit back in an erect position, overcoming the jolting motion by the flexibility of the body, and in this way avoiding any jar as well as sticking to the saddle. In this way the impetus will be felt to be forward rather than upward. The sense of tremendous animal vigor which one experiences upon the back of a spirited horse is both gratifying and inspiring.

Equestrian Polo is a very thrilling and valuable game, played on horseback, and with the object of sending the ball through the opponents' goal. Clubs are used, something in the form of a long mallet. Aside from the essential exercise involved in playing the game, the horsemanship required is of a very high order, and the mere riding through a game of polo upon a pony active enough to be of service in this game, will provide exercise of the most vigorous and satisfactory kind. The game is really limited to those of considerable means, however, and therefore can never become very popular among the masses. There are plenty of other satisfactory games that do not carry with them the same expense. A good polo pony is a rather high priced animal to start with, and the grounds and other requirements of the game are not always to be had.

Horseshoe Pitching.—See *Weight Throwing.*

Hunting.—Hunting is a very popular sport in many quarters and unquestionably has great value as a builder of health. It involves an unlimited amount of tramping in the open air, through the woods, over hills, sometimes on mountain sides, and the natural exercise of walking and climbing is accentuated by the fact that one has something to carry, always the gun, usually some provisions for lunch, and sometimes the game. It is not a violent or vigorous exercise, but is especially good for constitutional benefits because it takes one out-of-doors for all day, in most cases, and sometimes for weeks at a time.

There are many who could not consider hunting as a recreation because of its cruelty and inhumanity, but while this is to be deplored, there is no denying the fact that it is of a nature to build health and vitality. In this connection, however, it might be well to offer a personal suggestion to those who disapprove of hunting on ethical grounds, namely, that hunting with a camera is equally good exercise and in most cases more attractive sport than hunting to kill. A good snapshot camera will cost less than a good gun, and the incidental expenses are no greater. One can always find pleasure in an outing with the camera, and if no game is available, then one can always find beautiful scenes which are worthy of bringing home through the instantaneous impression upon a film.

Hurdling.—Hurdling is a combination of running and jumping (which see) which makes a spectacular contest. The aim of the hurdler should be to get over the hurdles as smoothly as possible, and without any more interruption of his running stride than necessary. The form of jump employed, therefore, should be as much like a big running step as possible, and the ideal form herein described approximates this essential.

It should be said that the first and all-important quality for good hurdling is speed, and hurdlers are therefore always fairly good runners, though there must be a combination of running and jumping ability. But since speed is the great essential, the athlete who is training for a hurdle race should devote most of his attention to sprinting, so that he may develop speed. About twice each week he should practice on the hurdles.

The two most popular and most frequently contested hurdle races are the 120-yard and the 220-yard hurdles, often called the "high hurdles" and the "low hurdles," from the fact that in the 120-yard

event the hurdles, ten in number, are three feet and six inches high, while in the 220-yard event they are two and a half feet high, also ten in number. In the latter case they are placed exactly twenty yards apart, with twenty yards to run from the start to the first one and twenty yards from the last one to the finish line. In the high hurdles, they are placed ten yards apart, with fifteen yards to run from the start to the first hurdle and from the last hurdle to the finish. They should be sufficiently light in construction so that if one does not quite get over them he will knock them down, rather than tripping himself for a bad fall.

In the high hurdles, it is necessary to run with an even stride, always numbering the same number of steps between the hurdles, either four or six, but preferably four, if one's stride is powerful enough and long enough, so that the leap will be made in each case from the same foot. In other words, the thing must be systematized. Young schoolboys will necessarily run six steps between the hurdles, and unless they can do this they are not big enough for hurdles of this height. Speed depends partly upon economy in jumping, and one should not waste time or strength in jumping an inch higher than actually necessary to clear the hurdles. Practice will enable one to master this phase of it.

As suggested, the leap should not be so much like an ordinary high jump as like a big step over the hurdle, one which will as little as possible interfere with your running action. Upon alighting on the forward foot you should be in a position to continue your running as though you had not made the leap. The old style of hurdling was to curl the forward knee sideways and inward, trailing the rear leg, but the new plan now used altogether is much better. It is to raise and extend the forward leg straight over, as though stepping over, trailing the rear leg from which the leap has been made. It will help in many cases to hitch the arms upward at the same time, with the action of sailing over the hurdle.

If one has speed and can master hurdling, it is a good branch of track athletics to take up, for there are not many who become proficient in it and there is less competition than in the sprints and the other runs. There are sometimes hurdle races for a quarter mile and other distances, but the two named above are the standard events.

Ice-Boating.—For those who love the open air, and especially the bracing touch of winter, there is scarcely anything more exhilarating than ice-boating. To travel, or rather to fly—for that's about the

feeling—at the rate of fifty or sixty miles an hour with the near-zero gale that your motion has brought into being stinging your face; to feel sometimes your deck rise to an angle of 45 or 60 degrees as a squall hits you on the quarter while you buzz along on one runner—to keep your eyes open meanwhile for air-holes and rotten ice and speeding rivals—all this is an experience for the novice, and a delight for the strenuous. It is great sport and picturesque at that. There in an unusually brilliant outdoor picture to be found in a fleet of racing ice-boats.

Allied to the ice-boat, but built to overcome conditions that would make that craft useless, is the scooter. This is a combination sloop and ice-boat that is found on the Great Lakes and the Great South Bay of Long Island. Originally designed for the use of winter fishermen and duck hunters, its sporting possibilities were later realized and nowadays scooter races are a recognized sport in the localities in question.

The craft is equally at home on ice or water. If, when sailing, it encounters a stretch of the former, it simply lifts itself thereon by means of the curved runners with which it is equipped and skates or "scoots" along until it meets with water again, when it slides off into that element and becomes a sloop until ice appears ahead, when it repeats the process.

It is not to be thought that the open air is all that one gets in ice-boating, for there is often a deal of exercise in manning the craft. Often, when the winds tend to tip her to one side, it is necessary to hang far out on the other side to maintain balance.

Jiu Jitsu.—This is the name of a system of self-defence in which the Japanese have become very expert. It is not, properly speaking, an exercise for the building of health and strength, but so much has been said about it in recent years that it is mentioned here. It is true that there is a certain amount of good exercise involved in its practice, and that one must be physically competent and alert to make use of it, but its fundamental principle is that of physical injury rather than of benefit. It is more or less of an art, a bone-breaking, tendon-twisting, ligament-lacerating art, designed to apply one's strength to parts of his antagonist which are weakest and least capable of resistance, also aiming deftly to turn his own strength against himself. There are all sorts of wrist twisting, joint dislocating and fancy methods of throwing an attacking adversary, though it may be said that most trained wrestlers know many such tricks, and really have

nothing to fear from a Jiu Jitsu artist. For others, however, it is an excellent means of self-defence.

Jumping.—There are two varieties of jumping commonly practiced in competition, the high jump and the jump for distance, called the "broad jump." These are both made running and standing, but the standing jumps are not used much in competition, being much less satisfactory and enjoyable to both spectator and performer.

In jiu jitsu the effectiveness of the movements used depends greatly upon the speed with which they are applied. It will be noted here that the man at the right of photograph has quickly seized the right arm of the man facing him, meanwhile passing his own right arm under his antagonist's forearm. With his left hand he bends the wrist of his adversary down, meanwhile pressing his right arm close to his body. This leverage destroys the balance of the man thus overpowered.

The running broad jump requires speed most of all, and the successful broad jumper is always a fairly good sprinter. With a given lift into the air, the distance that one will move before coming down will depend absolutely upon his horizontal speed, as a matter of physics. And for this reason the broad jumper in training should devote most of his attention to sprinting, prac-

ticing the jump not more than once or twice each week. Besides, broad jumping is a bit hard on the knees, and they should not be put upon this strain every day.

The jump is made from a take-off, a piece of timber planted crosswise and level with the running path, and the dirt cut away from the farther side. The dirt should be dug up loosely with a spade so as to be soft for landing. The first thing to do is to measure one's running paces, placing a handkerchief or other mark at a distance of eight or ten running strides from the take-off, so that you may be absolutely sure of reaching the take-off with the preferred foot each time. Experiment will determine this, and after a preliminary run to the handkerchief or other mark, a sprint is made from that point, according to the previously measured strides.

Having reached the greatest possible speed at the take-off, it is only necessary to get the upward lift in the jump, getting up as high as possible. Upon jumping you should raise your knees high, even to the chest, with the upper body and arms thrown well forward, and extending the legs again before alighting. This control of the body should be practiced a great deal in easy, moderate but rather high leaps, until the action is a matter of habit. You will then have the right form and will be ready to make real trials for distance.

The running high jump requires very little running, just a few easy steps sufficient to get a good spring and the horizontal direction to carry you over the bar when you reach the proper height. The essential thing in the high jump, aside from the necessary lift, is to get the legs up and out of the way when going over. The easiest and most popular form is a sideways jump, throwing one leg over first and following with the other. It requires practice. A very effective form is one in which the free leg (that from which the spring is not made) is thrown up forward over the bar, the body turning with the other side down and the other leg doubled up, so that the jumper alights with the body facing the bar. The aim is not to go over in an erect and perpendicular attitude, but to shoot over feet first, so to speak, so that the upper body may incline toward the horizontal. To jump a bar at five feet does not mean that the entire body has been elevated five feet, that is to say, that the center of gravity has been raised this distance, but perhaps that the center of gravity has been raised possibly three feet, and the position so shifted that dangling legs and other parts all get over. The most expert jumpers acquire a knack of getting practically the entire body

in a perpendicular position going over the bar, jumping sometimes over six feet high, but the art of accomplishing this is so intricate that it would be difficult to explain or make it clear in print. (See also *Hurdling,* and *Ski-Sliding and Jumping.*)

Leap Frog.—Leap frog is a good active game for boys, and naturally just as good for adults who are willing to forget their dignity for the sake of health. The simple and most common form of leap frog is the continuous running line, in which all take positions with backs bent over, hands on knees, while the last in the line vaults, straddle fashion, over each, finally taking his place at the front of the line, while the next one last in line proceeds in the same way, and so on indefinitely. A more exacting form of leap frog is one in which one man is down in a specified position, while the others take turns in trying to vault his bent back. A special take-off for the leap is provided, a leader setting the position to be occupied by the man who is down. The leader first vaults from the take-off, followed by the others, but he marks the landing place of his rear foot as the place for the man "down" to stand for the next series of vaults, naturally more difficult because of the longer leap. The first one who fails to get over properly, vaulting and placing one hand on the back, is "it," and must be "down" for the next series. As he is placed farther away from the take-off, the leader may specify, one step and a vault, or two steps and a vault, first doing it himself. The poorest jumper or vaulter is "down" most frequently in a game of this kind.

Lacrosse.—Lacrosse is a game that has been most popular for many years in Canada. It is said to have originated with the Indians. It is steadily increasing in popularity with American colleges. It is a great game for developing agility, quickness of eye and all-round vigor. It requires a large open field, and the ball must be played into a net-like goal.

Lacrosse is not a particularly hard game to play, but, as in tennis, the novice must be able to handle his stick well before he can learn much of the game. A stick used by an old player—a second-hand stick if it is in good condition—is better than a new one for a beginner. This is because, like a used tennis racquet, it has been well broken in by use and is not so stiff. In handling the stick, the beginner should always keep the ball close to the broad end of the stick, about a foot from the end, whether throwing or catching the ball, and well up against the frame. Should it be caught in any other position,

immediately shift it to the proper position for a throw. This is for the short throw or "tip." When a longer throw is made the ball is shifted lower in the net. Left-handed men can play as well as ordinary right-handed players, by simply reversing the side from which they throw.

Beginners should first try passing the ball from the stick up against a fence or the side of a building. Practice makes perfect, and, as in learning anything else, one has to keep continually at the game to master it. In throwing from the left side, the butt should be grasped with the right hand, with the left well up to the juncture of the net with the frame. Do not place the hands close together, as this gives less control over the stick. Move the arms freely and draw the stick well over the left shoulder, at the same time turning the body to bring the stick well forward while the ball passes out of the stick from the corner next to the frame. The stick should be given a light jerk upward at the same time, as this gives speed to the ball and projects it more accurately. As the ball leaves the net, draw the butt in slightly toward the body. The body must move with the stick, as this gives greater speed to the ball and insures more accurate throwing. By taking a step forward with the "off" leg, there will be less strain on the back and shoulder muscles. This is particularly helpful to beginners.

The next thing is to learn how to get the ball from the ground as quickly as possible. Placing the ball about forty-five feet ahead, still holding the stick with the two hands, but lowered instead of raised, the player approaches at a sort of dog trot, bends the knees and scoops up the ball "on the wing." With a beginner the ball will run out, or he may pass over it too quickly. But he will have to keep practicing, because when he once gets the ball he will have to throw quickly, and to do this must have it in the correct position for a swift throw. If he reaches for the ball too soon when approaching it, the ball will bound out, or he will push it away from the stick. A quick bend, scooping it up with a cradling motion, does the trick and then the player is ready for a pass. He should also keep the stick away from a line with his body or he may be taken with a sharp poke that will hurt. Experienced players of course know how to make the approach at speed, so that picking up the ball and passing it are done so quickly that they seem like a single movement. Not only must he attempt to pick up and pass the ball, but he has an opponent who is trying to do the same thing, and the

resulting collision of sticks and sometimes bodies is rather a heavy impact at times.

A fundamental rule, and one that obtains in all games where balls are used, is that hammered into the ears of every football player—"Keep your eye on the ball." A player should always keep in motion after he has once caught the ball—in fact, when playing toward the ball, if a player waits for the ball his opponent can come up and block his play, and if he steps backward the opponent has a chance to interrupt it before it reaches the expectant one. One must keep moving and step toward the ball, passing straight and hard, governing the speed by the distance between players.

Twelve men comprise a lacrosse team. The position assumed by the player must be such that his left side is always turned toward the goal he is attacking. The positions are: inside home; outside home; first attack; second attack; third attack; center; third defence; second defence; first defence; coverpoint; point; goal-keeper.

The inside home man of the opposing team lines up against the point man, and so on down, as in Rugby football, in a straight line from center to in-home, with the defence placing itself according to the attack. The ball is started from center or "faced-off." The two centers place their sticks back to back on the ground with the ball between them. In beginning each center must draw his stick straight toward himself and the ball goes to the side getting it first on this move. Then he passes to his next man and it goes from one to another, according to the system of play until the ball is lost to the opposite side or is landed for a goal on the opponent's side.

Shooting a goal is as important as any other part of the practice. It is not sufficient to be able to land it in the six-foot square. The shot should be as accurate as possible, because interference often gives the player little chance to get an easy goal. He must take a desperate chance and so be able to land it by a narrow margin in a small space. He must be able to shoot the ball in close to the goal post or sides of the goal. Here is where wall or fence practice comes in again, for a player learns to catch the ball on a rebound and shoot it in again, as he would in a game if he missed the goal and the ball rebounded. The ball comes back so quickly from the wall that he learns to catch it quickly and get in another shot before the goal-keeper in play could recover.

Leap Frog.—See *Jumping*.

Motorcycling.—See *Cycling.*

Motoring.—Although the automobile demands no exertion in getting about, as compared with such active exercises as walking and running or even cycling, yet the automobile should be given much credit as one of the prominent factors of recent years in encouraging a love for the outdoor life. Those who take very little exercise, and who otherwise might be confined to unwholesome recreations indoors, at least get the benefit of delightful outings in these motor cars. And for the man who sits at the wheel of his own machine there is a certain amount of exercise for the arms as well.

Many business men accompanied by their families now take an airing after the close of the working day, when formerly they would have spent the same time smoking a cigar in a lounging chair at home, probably with little or no ventilation of the room. For a large class of people motoring is a recreation, and one conducive to their better health.

Pole Vaulting.—Pole vaulting is an exercise which requires a powerful development of the upper body, though it may be said that it requires as much art as it does strength. So expert have some athletes become, in this branch of sport, that the present record is nearly thirteen feet. The beginner should practice on a bar not more than six or seven feet high.

There is really only one correct style, and it requires that one place his hands not too far apart upon the pole, as will be the tendency of the beginner. That is to say, while he will necessarily have hands far enough apart to carry the pole comfortably while making his run to the take-off, he should not have them too far apart while making the vault itself. It is best to make two marks, one some fifty feet and the other some one hundred feet from the take-off, so that the run may be properly gaged. One does not need the same speed as in broad jumping, but sufficient to carry him up and over, wherefore a good run is necessary, and the higher the vault, the greater the speed.

Before starting, the vaulter measures the height of the bar with his pole, placing his right hand slightly above this point, and the left hand lower down. In making the run it is best to have the point which is to be placed in the ground a little higher than the head, so that suddenly dropping the point will help with the upward impetus of the other end. The vaulter should leave the ground just as the pole enters it, for trying to insert the pole first will cause too much

of a strain both on the man and the pole. The breaking of the pole may mean a serious injury. The lower or left hand should be shifted upward as the pole is placed in the ground, the reason for this being that one can pull upward with far better effect when the hands are not too far apart. This pull is the important thing, so that upon approaching the bar the feet are swung up forward and raised higher than the head, the body shooting over feet foremost. The athlete lets go the bar as he goes over, throwing it back so that it does not hit the bar, also throwing his arms up so that they will not touch. The body turns during the vault so that it alights facing the bar. As soon as the right form is attained one should not practice at a moderate height, which does not require the decided upward pull, but should keep to such elevations as will demand the best speed in running and best efforts in vaulting. In training one should devote himself chiefly to exercises for strengthening the arms, chest and shoulders, practicing the actual vaults only two or three times a week. A vigorous development of the physique in general is necessary for pole vaulting.

Polo, Equestrian.—See *Horseback Riding.*

Polo, Water.—See *Swimming.*

Push Ball.—Push ball is a game suitable to a large number of boys or young men, as for instance, groups of students at a great university. It has been used at the American universities as a substitute for the brutalities of the "class rush." It involves so much of the elements of pushing and crowding that it is calculated to develop some of the hardihood and other qualities required in the modified Rugby football played in America.

Push ball is not a scientific game, but it is strenuous enough and stirring from start to finish. The ball is almost a balloon, being six feet in diameter, a round rubber pneumatic bag covered with leather, not unlike a gigantic football. Being put into play in the center of the field (a regular football gridiron), the object of each side is to push it toward and over the opposite goal. The science of the game, if there is any, consists in raising the ball from the ground by the united efforts of several players, and rolling it over the heads of opposing players. In the scrimmages there is a great deal of pushing and squeezing, the type of primitive scuffle which is one of the most natural forms of play or exercise, and which is conducive to all-round development.

Quoits.—See *Weight Throwing.*

fashioned appetite that insures a robust digestion. The cold winter air adds to the sport a bracing, invigorating influence which is most valuable.

In its influence upon the heart and lungs, as well as in its general constitutional effect, skating is superb. It calls into play and strengthens not alone the muscles of the legs, but to a large extent those of the sides, back and torso generally. In short, it involves the large and important muscles which are concerned with locomotion, either in walking or running. It is apparent that even a moderate use of these large muscles will call for an increased supply of blood and of oxygen, to an extent beyond that occasioned by a far more intense contraction of some of the smaller and less important muscles. Accordingly, even in leisurely skating, the heart and lungs are aroused to the most healthful activity, while the increased circulation and the stimulation of the functional system result in great constitutional benefit.

The alternate strokes upon the ice of the right and left legs provide for the alternate relaxation of the muscles of each side, a great advantage, this provision for intermittent or frequent relaxation being one of the essentials of an ideal exercise.

Skating is so readily learned that it is scarcely necessary to attempt by the written word to show how it is to be done, though we would suggest briefly for the sake of beginners that they cannot expect to skate well as long as they depend upon their legs alone. They should employ the muscles of the upper body, these acting in harmony with the legs, for a great part of the mastery of skating lies in the "swing," the graceful shifting of the balance from one leg to the other. If you find your progress slow, and your efforts hard work, you will know that you are not doing it right, for skating is anything but laborious, and you will only find yourself on the right track towards the mastery of the sport when you learn to do it with ease.

Ski Sliding and Jumping.—It is to Norway that we are indebted for the ski, a form of sliding and jumping snowshoe which affords some of the best and most thrilling sport of our northern winters. It is true that it requires a good provision of snow, but this is assured for a great part of the winter in Canada and the northern United States. The ski is much used in Minnesota, Wisconsin and Michigan because of the large numbers of Scandinavians settled in those States, but the sport has also been taken up extensively by native Americans.

The ski is made of a board six to eight feet long, of the width of the foot, and with the point bent up a few inches like the runner of

a sleigh. It is attached to the foot almost in the center by a couple of simple straps. For coasting the ski is more thrilling than the sled, because one stands up and maintains his balance even while going down hillsides which are nearly as steep as a cliff. The runners or skis are more readily kept in their necessarily parallel position than might be supposed, though it takes practice to become expert. Falls are numerous, but there is always a bed of snow which almost makes falling attractive.

But the big sporting interest of the ski lies in the jump. The small boy coasting knows what it is to go over a "bump," and it is just this on a large scale that the ski-runner enjoys, carefully building banks off which to leap at full speed, like jumping off a precipice. This "take-off" is located not far from the foot of the slide so that it is reached at full momentum, and usually has a slight upward incline upon its approach, thus tending to shoot the jumper up in the air. Ski tournaments are held annually in the States of the Middle West, at which the first-class jumpers in striving for records make startling leaps varying from one hundred to almost one hundred and fifty feet.

Snowshoeing.—The man must indeed be lacking in warm red blood who does not feel the call of the great open air when winter spreads its beautiful white mantle over the earth and keen breezes sweep down from the north.

But the country is frequently impassable to the pedestrian by ordinary means, when snow lies thick on the ground. Mother Necessity, however, came to the rescue in the dim past by suggesting to the inhabitants of cold climates an ingenious racket-like device with which even the deepest drifts could be negotiated with safety and ease, and thus the snowshoe was born.

For those who may not be acquainted with this useful invention of the Indians it may be well to say at the start that the snowshoe is a type of footgear consisting of a wooden frame of elliptical form, more or less rounded in front and running back into a point at the heel. Two or three battens mortised into this frame stretch across it, and the entire inner surface is filled with a network of hide, leaving only a small opening forward of the center to give play to the toe of the foot in walking. Resting upon this webbed support the foot cannot sink very deep even where the snow is lightest and the wearer is enabled to cover the ground with speed and comfort.

In selecting snowshoes there should be taken into consideration the amount of work they will be submitted to and the kind of territory

in which they are to be used. Different types are required for different localities.

Those about to visit the far north, where the dry and extreme cold keeps the snow loose and flaky, should choose a large and finely knitted shoe that it may have plenty of supporting surface, without obliging one to lift at every step the clumps of snow that attach and cling to a heavy weave. On the other hand, in more southerly regions, where the dampness of the air causes the wet snow to pack and often to crust hard, a smaller shoe can be used, but heavier filling is advisable.

Of course the conformation of the country to be visited must also influence the choice. One intending to hunt in the woods, for instance, will have to select a different model from the man who expects to find only open and flat ground, and a shoe totally different from both must be picked for hilly or mountainous country. A snowshoe having a long toe or a far-trailing heel is not only dangerous but quite unfit for traveling up and down hill.

In mountain climbing a short, compact shoe is necessary and the bear-paw type gives excellent service.

In taking up snowshoeing it is most unwise to venture out on a trip of any kind before having had plenty of practice near home. To walk on snowshoes looks easy enough, as do most difficult feats—when performed by an expert. As a matter of fact considerable skill is needed to navigate properly on them and the action is so totally unlike that of ordinary walking that many a pitfall is open to the over-confident.

Particular attention should be given to walking with feet straight in front and wide apart, and to lifting the knees well in pushing the shoes forward. The width of the rackets, requiring a space of anywhere from twelve to sixteen or eighteen inches between the feet to prevent interfering, makes the going awkward and uncertain until one has become used to it. The man who fails to allow the necessary play will likely be treated to some nasty falls. Likewise, if the knee is not raised enough the toe will catch in the snow and throw one forward to a heavy cropper. The novice is very liable to stumble this way, because in observing experts the idea is formed that the motion is a gliding one, this idea being given by the trailing heel of the snowshoe and the heavy side-to-side lurch of the body as the snowshoer rests his weight first on one, then on the other shoe. But the motion is far from a gliding one. Rather is it to be compared with the action of a high-stepping horse.

The heel rises from the snowshoe at every step and the toe bends over the toe-hole in the shoe, allowing the racket to swing as on a swivel. And the novice needs to be cautioned against allowing the foot to protrude too far over the toe-hole. Carelessness in this respect has caused serious trouble even to old timers.

However, snowshoes made for the market cannot always be relied upon. Not that this statement should be taken as a general condemnation of trade shoes, for there are firms whose integrity is beyond question and who use only expert workmanship and the best material. One does at times meet with shoes of inferior quality, however, and it is just as well to caution the unwary. Particularly should those be careful in selecting their snowshoes who are about to trust themselves in far away, unfrequented places, to these ships of the northern wastes. One is apt to find among store-made shoes defective frames that will break or wear out and fillings of beef hide that will stretch and sag dangerously after a wetting. A hopelessly broken shoe may come to be a matter of life and death, under certain conditions, and it is a sensible plan to minimize the chances of mishap by taking the trouble to obtain a first-class pair of shoes hand made by one who builds only a limited number and gives each pair utmost care in every detail.

Soccer.—See *Football.*

Swimming.—Swimming is one of the most attractive of all summer sports because it combines the delights of bathing with the pleasures and benefits of a most satisfactory and perfect form of exercise. Practically all parts of the body are employed in the various swimming strokes, and not only this, but the use of the various members of the body is such that it requires the full and complete use of the muscles which has been pointed out elsewhere as an essential of ideal exercise. Swimming involves the full sweep of the limbs and also vigorous activity upon the part of the muscles of the torso. It is an exercise well calculated to develop symmetry and a uniform strength throughout all parts of the body.

It is in the power of anyone to master unaided, and in a very short time, the principles of natation sufficiently to meet ordinary requirements, but it would be a poor kindness to the prospective swimmer not to add that a high degree of proficiency—according to present-day standards—cannot be attained without the aid of competent instruction, or at least the constant example of expert talent. This candid statement is not made with any intention of discouraging the beginner, but for the purpose of impressing on those having the facilities to

place themselves in the hands of good teachers, the wisdom of doing so without loss of time. It is by far the shortest and most satisfactory road to success.

Experience has proved beyond a doubt that the most modern of the so-called speed strokes—the trudgeon and the crawl—are not only the best for all-round swimming, but also for developing harmoniously and symmetrically every set of muscles in the body. They are the result of long years of studying the application of scientific principles to the art of obtaining the greatest amount of speed and endurance out of the forces at our disposal.

Breathing in swimming is timed to suit the different strokes. The beginner must realize the absolute necessity of inhaling and exhaling correctly if ease and form are to be obtained. Both the comfort of the swimmer and the smoothness of his stroke depend so much on proper breathing that proficiency cannot possibly be attained with a defective system.

In learning to swim, the use of sustaining appliances can sometimes be recommended, for in some cases, particularly if one be of a nervous disposition, or inclined to fear the water, they help to inspire confidence and, of course, they are indispensable if one has to learn alone and only deep water is available.

Of the various floating devices now in existence the air-inflated ones are most satisfactory both because they can be adjusted so as not to interfere in the least with one's movements, and because the air can be gradually let out, so that one passes in almost unconscious stages from an overabundance of support to none at all. The word overabundance is here used intentionally to emphasize the fact that no artificial support of any kind is needed to keep one afloat.

The body floats naturally, whether supine or face down, and if the nostrils and mouth were to be sealed it could not possible sink, for the lungs act as an air chamber and make its weight lighter than the amount of water it displaces. People would never drown could they manage to keep the lungs free of water. The trouble lies in their not knowing enough to hold their mouths above water. In their frantic efforts to save themselves they inhale water instead of air, the lungs fill, and the buoyant center being destroyed the body sinks.

The aid of both floating devices and a companion is moral as much as physical, yet none the less necessary.

One of the most prevalent faults among beginners is to believe

that correctness of form lies in stiffness of muscle. This is particularly wrong in the case of swimmers, because relaxed muscles will adjust themselves almost naturally to the proper position.

Never tire yourself, in the beginning; stop and rest as soon as you begin to feel fatigued. You will improve more readily. And realize from the start that when you are able to go through thirty or forty slow strokes, without resting, you know how to swim. After that it is merely a case of practice and development.

In regard to both the healthfulness and the danger of swimming, a distinction must be made between the exercise itself, and the action of the water. A comparatively long immersion, especially in cold water, may prove harmful, where the exercise alone would not have been excessive. The advice to leave the water before a feeling of cold is experienced, is as trite as that to the effect of leaving the table while still hungry, and is about as likely to be followed. Certainly, however, common sense should tell us to leave the water *after* the chilly feeling comes on, and not to wait till a fit of shivering proclaims a still greater distress of the body. Beginners are more likely to suffer in this respect than are advanced swimmers, since they are obliged to take frequent rests while in the water, whereas the experienced swimmer can keep moving.

Tank swimming may to the uninitiated appear as a milder form of the sport, but in reality it is not so. The small body of water becomes more quickly and more irregularly agitated than a larger open-air surface, and the increased liability of running into someone does not conduce to ease of movement. The "turns" that can be made at the end of a tank seem at first to give a slight rest to the swimmer, but when continued they are really a more vigorous exercise than swimming itself. To the beginner the turn is a valuable illustration of how the swimming kick should be made, for if there is one point above all others in which the learner fails, it lies in not presenting the soles of the feet and the palms of the hands squarely to the water. The football kick is the one which should *not* be used.

Water Polo.—Water polo is an adaptation of the game of polo to the water, being a sport much enjoyed by those who are expert in both swimming and diving. One who cannot swim rapidly and continuously will naturally be unfitted for it. It is played with an inflated ball, and may be said to be as much like a basket ball adapted to the water, as like polo, except that the basket ball goals are not used. The opposing teams endeavor by hitting and throwing the

ball to force it through their opponent's goal as in other games, and it frequently happens that diving is necessary to elude an opponent, or sometimes, to push another under the water to interfere with his prospective play. Strenuous and vigorous in the extreme is this water game, and admirable for purposes of physical development, inasmuch as the different forms of swimming employ all of the muscles of the body. Water polo is to swimming what hockey is to skating on the ice.

Drowning; First Aid Methods.—The following useful and practical directions for reviving the partly drowned were issued some years ago in the form of a placard by the Michigan State Department of Health. (See also *First Aid* under *Asphyxia,* Vol. II, p. 459.)

Rule 1.—Lose no time in recovering the body from the water. Always try to restore life; for while ten minutes under water is usually the limit, still persons have been resuscitated after being under water for thirty or forty minutes. Do not lose time by taking body to a place of shelter—*operate immediately.*

Rule 2.—Quickly lay the person prone, face downward, with stomach resting on a barrel or roll of clothing, so the head will be lower than the rest of the body and water will run out from the throat

Showing the Schafer method of resuscitation after submersion. In the first position, here illustrated, a roll of clothing (of at least one foot diameter) or some such round object as a barrel, is placed under the abdomen, with the head at a lower level. Pressure is applied, as illustrated, to assist in expelling water from the lungs. The arms preferably should be so placed that the forearms extend in the direction of the head.

and lungs. Wipe dry mouth and nostrils. Wrap the corner of a handkerchief about the forefinger and clear the mouth of all mucus and slimy substance back as far as the top of the throat. Rip open the clothing on chest and back and keep face exposed to air. Separate jaws and keep them apart with a cork, stone or knot in a handkerchief. (See First Position.)

Rule 3.—Remove the roll of clothing from underneath the stomach of the patient. Kneel by the side of or across patient. Place your hands over the lowest ribs. Lean forward and put your weight straight over the lowest ribs. *Exert this pressure for three seconds.* To count three seconds, say: "One thousand and one, one thousand and two, one thousand and three." (See Second Position.)

Rule 4.—Do not remove the hands from the ribs; but *release the pressure from the ribs for two seconds,* by squatting backward. To count two seconds, say: "One thousand and one, one thousand and two." (See Third Position.)

Rule 5.—Again exert pressure straight over the lowest ribs for

After expelling water in the Schafer method the roll of clothing or other elevation beneath abdomen may be removed. The face downward position, with mouth free and wide open, is maintained. Breathing is stimulated by pressing firmly upon the part of body under the shoulders to expel the air from lungs and then drawing hands down and away to permit the inflation of lungs. This movement is continued until breathing and consciousness are reestablished or until there are definite signs that resuscitation is beyond hope.

three seconds, and as described in Rule 3; then again release pressure for two seconds, as described in Rule 4. Alternate thus (three seconds pressure and two seconds release) about twelve times a minute, until breathing is restored. This method of resuscitation at once expels water and produces the identical results of normal breathing.

This method is what is known as the Schafer method of Artificial Respiration.

Rule 6.—If another person is at hand to assist, let him do everything possible to keep the body warm, by sheltering it from the wind, rubbing hands and soles of feet, making hot applications. Camphor or ammonia may be applied to nostrils to excite breathing. Warm the head nearly as fast as other parts of the body.

Rule 7.—After breathing is restored, remove the patient to a warm bed where there is free circulation of fresh air. Administer in *small doses* stimulants (hot coffee, ginger tea, hot sling), being careful not to let the patient choke or strangle. There is danger that the patient may suffer congestion of the lungs and have great difficulty in breathing. When this occurs, a large mustard plaster should be placed over the lungs.

To keep from drowning, it is advisable, but not necessary, to know how to swim. One finger placed upon a piece of board, an oar, a paddle, will easily keep the head above water. Breathe, and keep a cool head, and you will be able to keep your head above water until help comes.

The above instructions may be modified or improved by substituting hot wet packs for the mustard plaster, and hot water, hot lemonade or hot diluted grapejuice. Attention again is directed to Vol. IV, Part 7, *First Aid in Accidents.*

Tag.—See *Running.*

Tennis.—Lawn tennis is an ideal outdoor game for both sexes. It has the advantage of being of such a nature that the players can make it as fast and active as they may choose. It develops speed, a clear eye, accuracy, suppleness and grace, together with a normal and vigorous degree of strength in all parts of the body. If anyone unacquainted with tennis fancies that it is a ladies' game, he need only practice it long enough to acquire the skill necessary for a fast game, and he will find it as strenuous as he desires.

Tennis is played on a court 78 feet in length and 27 feet in width (for singles), and 36 feet in width (for doubles). Singles means playing with one person on each side, whereas a game of doubles

includes four persons, a team of two partners on each side. A light, elastic ball two and a half inches in diameter, and a racket made of a sort of oval wooden frame, about 8 inches wide and 12 inches long, with the open space strung with a network of catgut, and with a handle of about 15 inches in length, constitute the implements. The ball is played over a net stretched across the center of the court and answering the purpose of a fence. The ball must be played over the net and within clearly marked limits of the court, failure in this meaning points for the other side.

Never hold the handle loosely, and always grasp it at the extreme end. No other bad habit interferes with successful playing more than holding the handle in a loose, unsteady manner. Grasp it firmly, otherwise your efforts will be useless. Playing against a blank wall furnishes excellent practice when an actual contest is impracticable.

To baffle one's opponent calls for much shrewdness and skill, and a good player most thoroughly enjoys the game, when pitted against an opponent of equal or greater skill. A game easily won is not so intensely interesting, and one may weary of the lifeless play, but when it is necessary to constantly watch the ball and to always be on the alert, then game after game can be played with the interest continually increasing. When competing against a skilled player one develops speed most rapidly.

Much endurance is gained through the playing of tennis. So much running about is necessary, so rapid and constant are the movements, and so sustained the mental efforts involved that tennis becomes an exhausting game. The heart action incurred by the exercise is necessarily vigorous, and the increased muscular activity calls for more rapid respiration.

The fact that tennis is primarily an outdoor game is a great advantage in itself. This not only enables the players themselves to secure an abundance of oxygen, but any spectators are also benefited by the fresh air and ideal surroundings.

A free and easy costume should be worn on the tennis court. Ordinary footgear should be replaced by tennis shoes, the conventional attire should be discarded. The true lover of the great outdoors expects and wants to show the result of an active, energetic life. A good healthy color is much preferred by the modern woman to the delicate, white, chalky appearance of her more "gentle" sister. The free and easy costume of the tennis court is a grateful relief from conventionality to the sensible woman.

Tobogganing.—See *Coasting*.

Track and Field Athletics.—This is the designation given to a certain class of sports practiced on the running track and usually also upon the field inclosed by the circular running track commonly provided on athletic grounds. Under the head of "Track and Field Athletics" are included running races, for short and long distances, hurdle races, jumping for both height and distance, pole vaulting and several forms of weight throwing, including thereby a variety of exercises calling for speed, endurance and great strength. These various forms of competitive exercises are here taken up separately. In connection with these the reader is also referred to *Training* in the introduction of this Part.

Tug-of-War.—Tug-of-war is a grand game for those who are strong and in a physical condition to exert themselves to the limit of their strength. For those who are frail or imperfectly developed, it is too vigorous and violent. Yet, if they can stand a moderate measure of the strain of a tug-of-war, this strenuous exercise will go far to making them tough as leather and as hard as a powerful, athletic man may be. In its very nature it means that every man on each team shall exert himself to the utmost limit of his strength, and that for intervals sufficiently long to try him out thoroughly. For those interested, we might suggest that special training for lung power and endurance will be of special value. With superior endurance, one team will always defeat another of equal weight and similar strength that lacks the enduring power. The first half-minute will not reveal the difference in physical condition, but after that the benefits of proper diet and sustaining lung power will assert themselves.

The heavier the rope used, the better. To judge a contest it is well to tie a white handkerchief in a knot upon the middle of the rope, this being exactly over a certain mark. When both sides are ready, a signal is given and the tug is on. When the knotted handkerchief shall have been pulled a special distance agreed upon, one, two or three feet, to either side of the mark, the bout is won. The bouts may be timed, so that they may be awarded to the team having the advantage at its expiration. One or two minutes is usually enough for a bout, and a contest usually consists of three bouts, the best two out of three winning. Usually there are six men to a team, but for purposes of exercise or practice there need not be more than two or three to a side. If played indoors on boards, cleats of wood should

be provided crosswise, to brace the feet against. Even outdoors, the tug-of-war may best be contested on a course of planks provided with such cleats.

Vaulting.—See *Jumping* and *Pole Vaulting.*

Weight Throwing.—Weight throwing offers a form of exercise very different from the other track and field sports, and one which is very valuable for the development of rugged strength.

Putting the shot is much like throwing a cannon ball, though the "put" is not an overhand throw, but a straight push out from the shoulder. Sixteen pounds is the standard weight, though high school boys often use a twelve-pound shot, and still younger boys sometimes an eight pounder. The shot is "put" from a seven foot circle. If one steps outside of this, it is a foul and the effort does not count.

The purpose of the athlete should be to acquire such form that his legs and body may help him to express all possible power in putting the shot. It is not done with the arm alone, as it may look to be. In putting the shot with the right hand, the athlete should bend far back and down to the right side, then, drawing the left leg back and instantly throwing it forward again, a little hop is executed which brings the athlete to the other side of the circle, in the same position of the upper body, but with both knees bent, especially the right. Now, continuing the impetus gained through this hop, the put is made with all possible force, from the legs up, not only thrusting the shot out with the arm, but raising and bringing the right shoulder around with it so that as it leaves the hand the body has turned halfway around, and the left and right feet having changed positions. To get this hitch it is well to practice this little jump, turning half around so that the right foot alights where the left foot has been, also thrusting out the right arm. All methods of developing strength are of value in training for the shot-put.

Throwing the discus is a revival of the ancient and classic sport of the Greeks. The discus is a four-pound disc, made of wood, brass and steel, eight inches in diameter, a half inch thick at the edges and two inches thick in the center. It is like two plates placed together, convex sides outward, and in throwing the object is to make it sail through the air as far as possible. It is thrown with a full sweep of the arm. The fingers are spread out over it, the last joints of fingers and thumb hooking over the edge, and it is held palm down, retaining its position in the hand through centrifugal force during the swing on the throw. The athlete starts by bringing the arm

down and far back, preparatory to throwing it in the direction toward which his back is turned, thereby giving it a sweep of 270 degrees or three-quarters of a circle. It may be thrown in this way, and without a turn, as was the custom of the Greeks, but discus throwers of the present time make a complete turn around of the body to give greater impetus. After learning to throw it as well as may be without this turn, the athlete can then profit by adding this feature. To make this turn, the athlete starts out as though to throw it, but when the arm gets well around he executes a complete turn of the body, feet alighting facing the same direction, and with the arm following around with increasing momentum.

It is a splendid exercise for the chest muscles, but for the best results should be practiced with both left and right hand.

Throwing the hammer is probably the most interesting of the weight-throwing events, but care should be taken that spectators are not too close. The standard weight is sixteen pounds, though a twelve-pound hammer is used by schoolboys and those not heavy enough for the heavier size. A flexible steel wire handle is used, with a double loop for the grip so that one may take hold with both hands, the length, over all, being four feet. Like the shot and discus, it is thrown from a seven-foot circle. Thrower stands with his back to the direction in which it is intended to throw it.

The simple throw, without turns, should be mastered first. With hammer on ground to the right, swing it around in front to the left, back over the head and around, swinging it around the head with increasing momentum three times, toward the ground in front, and high back of the head, finally, with a smart backward pull, letting it fly straight backward. After getting this form perfect, learn to throw with one turn. First swing as before, twice around the head, and as the hammer swings back behind you for the third time, turn around once quickly, facing the same direction as before, and conforming to the momentum of the hammer. If it is done right, the pull of the hammer will help you to make the turn; you should then give a pull upon the hammer in turn, increasing its momentum, and with a final backward tug, let it go flying. Having mastered the secret of the one turn, and working in harmony with the momentum of the hammer, you can soon acquire two or three turns and enjoy the satisfaction of seeing the weight fly far up and away.

Throwing the fifty-six-pound weight is similar in execution to the throwing of the hammer, except that it is done with a very short

handle and requires great strength rather than the combination of strength and speed necessary for throwing the hammer. It is suited to heavyweights only, but the same exercise, with a thirty-five-pound weight, would be admirable for building strength in the case of lighter men. Starting from the right side, the weight is swung just once around the head and then just one turn is made, whereupon the ponderous missile is hurled backward. Throwing the fifty-six-pound weight for height is sometimes included in athletic games, but it is not much practiced.

Pitching Horseshoes and Quoits.—Quoits is a modest old game for outdoor play, but one which still holds a peculiar interest to all those who have played it enough to get acquainted. The original form of the game employed rings, to be thrown from one stake to another, points depending upon throwing the ring over the peg or upon getting one's rings closer to the peg than opponent's. Rings are still used in the game, in this way, but for the most part it is played with horseshoes. It has no special or remarkable value as an exercise, but is a pleasant open-air diversion.

Wheeling.—See *Cycling.*

Wrestling.– There is no sport or exercise in the world better suited for building vigorous manhood than wrestling. It calls for speed and activity, it demands the utmost endurance and it develops strength in the highest degree. In its very nature, that of a competitive man to man struggle, it necessarily brings out all of the physical qualities by which one man might expect to subdue another under primeval conditions. In a way, it takes one out of the stilted, artificial, civilized life of today, back to the original natural conditions of life in which primitive man grew strong through grappling bodily with his foes. Wrestling is the play form of the world-old hand to hand struggle which in the beginning usually meant life or death, instead of merely forcing an antagonist helplessly upon his back.

There are several forms of wrestling more or less practiced at the present time, but of all these the "catch-as-catch-can" style is the best and most universally employed. Elsewhere the reader will find a description of so-called "hand wrestling," but though it is a splendid exercise, it is not a true form of wrestling. The catch-as-catch-can style permits of the greatest variety of holds, including practically every part of the body, and requires that two shoulders touch the mat at the same time to constitute a fall. The Greco-Roman style is similar in most respects to the catch-as-catch-can, except that wrestlers

are not allowed to take hold below the waist line. It is naturally popular with those who find themselves best suited to this style.

Though wrestling is a magnificent game for developing hardihood and strength, yet it is so strenuous that one should be in a fairly hard and vigorous condition before attempting it. It is not a sport for the weakling, for not only will he be unable to accomplish anything with his endeavors, but he will also be likely to strain himself. Therefore, unless one is fairly well seasoned in other forms of sport and exercise, it would be best to take two or three months of good, faithful training with special exercises, and perhaps a little distance running for endurance, in order to be fit for the mat.

It is unwise for the novice who knows nothing about the game to attempt to wrestle in earnest, that is to say, he should not strive hard to throw his antagonist, as in a match. He should first take up and study various holds and the means of breaking them, in order that he may make no mistakes or acquire bad habits of style. Each hold should be secured quickly time after time, without exerting too much, and practiced in this way until it is mastered. After thus mastering the important positions, the pupil will be ready for real wrestling. As in other things, practice is the essential to good form, and much will be learned in this practice. Special attention should be given to bridging, for there are many circumstances in which this is temporarily the only way of avoiding a fall. This will also strengthen the neck for resisting other holds.

The first thing to be done, as one faces his opponent, is to get him off his feet, putting him on his back at the same time if possible, but at least getting him under so as to permit of further aggressive efforts. Once on the mat one is either aggressor or on the defensive.

While on the defensive one should always be alert for opportunities to take the aggressive. Especially should he be ready to seize the arm of the man on top and roll over, thereby rolling him on his back. On the other hand, the aggressor must be careful to watch out for such tricks. It is well to keep the elbows close to the sides. While on the defensive, also, one should use his legs as a means of resisting many holds. Clever wrestlers depend upon their legs in this way a great deal, locking or hooking them in those of the aggressor. In all arm holds it is well to take hold as far down as possible, preferably at the wrist, for this gives a greater leverage. The mechanical principle of leverage is involved a great deal in wrestling, for much of the work consists in turning over on his back a more or less

prostrate and stubbornly resisting man. Reaching under his body and taking hold of the "further arm" or the "further leg," therefore, are common holds. This principle of leverage for turning him over is also applied in the various "Nelson" holds.

When on the offensive, use the weight of your body as much as possible, for this will not only help to give you power in many instances, but it will help to tire out your adversary all the more quickly. When working over his shoulders simply rest all of your weight upon him. The aggressive work is the harder, anyway, and if you can make him support your weight it will make it more

In this wrestling hold, the man on top attempts to prevent his opponent's release by clasping his adversary's head firmly under his knee Meanwhile he applies the wrist-and-arm-lock here shown in an attempt to turn his opponent over. It may be noted that the defensive tactics shown on the part of the wrestler on hands-and-knees are not up to the standard of modern wrestling.

interesting for him and help to even up the results in strength-building on both sides.

After learning the first principles, as it were, one should devote himself to a study of the strategy of the game, for in wrestlers of nearly equal strength it is usually head work that wins. Feinting is as valuable as in boxing, or as in the operations of two opposing armies in the field. The purpose should be to conceal the real intention, to mislead as to the real hold desired, and then to get it indirectly. It is seldom that one can win a fall by the first hold attempted anyway, but one hold should serve as a means of getting another better. Learn to slip rapidly from one hold to another in order to keep your opponent bewildered, and once you have the right hold, work very quickly. Try to overwhelm him with your energy and speed before he knows what you are trying to do. Quick work is what counts in a great many cases, and a combination of speed and strength is necessary to make a really good wrestler.

The student of wrestling should make it a point to work out combinations of the simple holds, such as the combination of half Nelson and crotch holds still in occasional usage. Infinite variation may be secured by these combinations. It should be noted that the instructions given here are not expected or intended to make experts in wrestling, but the game is such a perfect exercise and of so much benefit in building both health and strength that every young man should try to find time to do some of it. Anyone may learn enough to be able to get the benefit of the exercise to be found in wrestling, and perhaps to make a fairly good wrestler from a competitive standpoint as well. We should especially recommend taking up the game in the amateur way. Professional wrestling has its place as means of stimulating interest, but it is better to regard it merely as sport and exercise.

The value of wrestling as a means of developing a powerful physique should be emphasized, taken either by itself or as supplementary to other exercises for the purpose.

The physical strength and toughness derived from wrestling make it one of the most valuable of exercises. But the character development resulting from its practice is of even greater value. The qualities of courage, pertinacity, and alertness, the ability to endure punishment, to attack vigorously without anger, to win without exultation, and to lose like a true sportsman, these the young wrestler must strive to attain.

GROUP GAMES AND ACTIVITIES

THE advantages of games and sports that can be engaged in by small and large groups without previous specialized athletic training have long been recognized by those interested in physical culture. Through such games appreciation of the pleasure and profits of exercise may be developed in those who engage in them, and the competitive spirit made to serve a useful purpose for not merely a handful of participants who exhibit their prowess before a far larger group of spectators, but for all of the members of a group, without regard to their skill in specialized athletics.

The games that have been found most effective in Group Activities, as presented here, have been compiled by physical directors, school and college trainers, and by playground directors. They are here classified as Mass Field Games, Line Games, Circle Games, Tag Games, Miscellaneous Games, Rest Games and Strength Tests, the minimum and maximum number of players that may engage in each different class of game appearing before these various groups of activities.

Mass Field Games.—*The "Shuttle" Method of Group Competition* is so called because competitors are drawn first from one and then the other of the two columns of file in which those engaged are equally divided. The man at the head of one column takes a jump, if this be the event to be contested. His record is marked, and the man at head of opposite column jumps from that point in an opposite direction, trying to jump back to first man's starting point or farther. Opposing teams jump back again in this shuttle fashion until all have competed. If the last man on second team fails to jump to starting point of the man against whom he jumps, the first team is declared victor.

A stationary line such as a tennis tape or plank sunk edgewise is placed between the heads of columns. It is of advantage to have the shortest men placed at the heads of both columns.

The only equipment required is a permanent take-off line from which events are started, and two sharp sticks to mark progress of contestants in various events.

Here are some suggestions as to the events that may be included: Standing Broad Jump, Running Broad Jump, Standing Hop, Running Hop, Hop Step and Jump, Shot Put, Three Broad Jump, Back-

ward Jump, Medicine Ball Throw, Football Punt, Football Forward Pass.

The Relay Type of Group Contest requires a rather large field for competition, but has the advantage of permitting large bodies of men to engage with practically continuous action.

One hundred men, for instance, may be divided into ten teams of ten men each. Each team quickly arranges itself in column, and the man heading each column jumps as far as possible—if this be the contested event. The second man in each column then jumps in the same direction—in other words relays the first man's jump from the point to which the first man has reached, the column moving up to permit every man to jump in turn. The column covering the greatest distance is the winner. The same equipment as for the shuttle type is adequate, and the same events may be included.

Suggested Events for Relay Athletic Meet.—*Teams Relay.* Competitors are placed at equal intervals in column from five to fifteen yards. The first runner is given a wand or flag. At the signal to start he carries same to the second runner, who carries it forward to the third, and the race continues until the last runner crosses the finishing line.

Standing Broad Jump.—All members of each team relay each other to cover as great a distance as they can.

Frog Race.—This race is similar to the Team Relay except that the competitors travel forward in frog leaps instead of running. This should be arranged at at least five intervals. The second contestant is tagged off by the first, etc.

Standing Hop.

Leap Frog Jump.—The front man in each column assumes a stooping position with hands on knees, toeing the starting line. Number two man takes a run and leaps over number one, resting hands on back during the leap. The point where his heels strike the ground is marked, as in an ordinary jump. He then goes to the rear of the line and the event continues this way until the man who headed the column has taken his leap. Composite distance determines the winner.

Crab Race.—This race is the same as the Team Relay with the exception that competitors run on all fours, face up, feet first.

Medicine Ball Throw Back of Neck.—Ball is held by both hands behind neck and thrown backward.

Line Games.—In line games the teams, of equal number of contestants, are arranged in columns, or files, not less than ten feet sepa-

rating these columns. The first man in each column should toe the starting line, all men naturally facing same direction. Another line to serve as a distance line is placed about thirty feet from and parallel to the starting line.

When large numbers compete it is advantageous for the men finishing the relay to wear some distinguishing mark that the judges may quickly discern the winner, though otherwise the last man may hold his hand up as high as possible upon finishing.

Novelty Relay Races.

Minimum number on each team	8
Maximum number on each team	30

Leap Frog Race.—(No equipment needed.) Players stand in column, four feet between players. At signal "Ready," all stoop down; at signal "Go" last man takes frog leap over backs of all men preceding him in line and assumes stooping position at head of column. Player at rear end of line then repeats this procedure, likewise the man remaining there after he has jumped over all his column, and so on until every man has jumped. When the man who headed the column has jumped over the backs of his team-mates, he runs forward over finish line, and if he be the first man to reach it wins the race.

Flag Race.—(Equipment required: one flag for each team.) All players facing the left, the flag is thrust into ground at the starting line. At starting signal the first man raises flag and quickly passes it to next man in line, who follows suit until flag reaches last man in column, who takes the flag and runs in front of his line to the distance line. Returning to the head of his column, he again passes flag along, and so on until all have run to distance line, in their turn, with flag. The first team to have the man originally last in its column to reach distance line wins race.

Skin the Snake.—(No equipment needed.) With players in regular column file position, each player reaches backward with right hand between legs and grasps the left hand of the team-mate behind him, until entire column has joined hands in this manner. At signal to start the last man in the column lies down, retaining firm grip on the hand of man standing astraddle. Entire column, with hands clasped, pass backward over him, ahead of him, and keeping feet together. The man next to last then lies down in same manner, until entire team is outstretched upon ground. The man last to lie down, who originally stood at head of column, rises quickly as possible and moving forward, straddling the line, pulls the man behind with him so

that entire team is pulled to its feet in this manner. The line getting to its feet first, without having broken, wins race.

Wheelbarrow Race.—(No equipment needed.) The first man in each column places his hands upon ground. The second man grasps the first man's knees, and supports them on each hip, forming a human wheelbarrow across distance line.

Centipede Race.—(Equipment required: a pole or rope for each team, allowing one foot in length for each man to compete on team.) Players line up stride pole or rope, which must be behind starting line. At signal to start the team runs forward until last man is across finishing line. It then turns about and returns. The race is finished when the last man crosses the starting line.

A similar contest not calling for equipment requires that players lock arms around the man in front of them, and keeping step proceed otherwise as in Centipede Race.

Jump Stick Relay.—(Equipment required: one stick about three feet long for each team.) The stick is held in the hand of the first man in the column. Upon the signal to start he runs to the distance line, touching beyond line with stick. He then returns to the head of the column and hands the other end of the stick to number two. Then, holding the stick between them and near the ground, they run to the rear of the column, every man in line jumping over stick as it reaches his feet. Upon reaching the rear of the column, number two takes the stick and runs to the finish line, then returns to starting line and with number three holding other end of stick passes it to the rear of line once more. The game is continued until the last man in line carries the stick across the finishing line.

Rescue Race.—(No equipment needed.) At signal number one turns and bending over gets his right shoulder well under crotch of number two, then reaches under it, in front of his body, to grasp number two's right hand, passed over his shoulder. In this position number one can walk or even run while bearing a man larger than himself. After carrying rescued man to distance line, and returning still bearing him, to head of column, he passes to rear of line, leaving number two to carry number three in same manner, and so on until all have taken part in race. Race is won by first team to have the last man in its original column formation to cross finish line.

Monkey and Crab Race.—(No equipment needed.) At the signal to start the first man in column places his hands upon the ground and walks to the distance line in monkey fashion. Upon reaching same he

assumes a running position and returns to starting line, where he touches number two and then passes to the rear of column. Number two gets down on hands and feet, facing upward, to imitate crab, and walks in this manner, either head or feet first to the finish line, then runs back to touch number three, who runs to line in monkey fashion. The rest of the team continues this alternation, one running face downward and the other face upward, until all have crossed the finish line and returned to starting line, the first team to accomplish this without fouling being the winner.

Paul Revere Race.—(No equipment needed.) Players take position in columns in open file order, with fifteen or more feet between players in each column. From each team a slight player is selected to act as rider. He starts just back of the last man in the column. Upon the given signal he leaps upon the back of the last man, who carries him to the man next in front of him. The rider then must change from the back of the first steed to the back of the second without dismounting or touching the ground. The second steed carries him to the third, and he thus is carried from player to player until he reaches the first man, who carries him across the distance line, and who wins the race if first to finish in this manner.

Dizzy Izzy Race.—(Equipment required: one baseball bat or stick of similar length.) At signal, first man in column grabs stick and runs to distance line. As soon as he crosses it, he stoops with stick held to center of his forehead and resting on ground and circles around in this position five times. He then returns to starting line to pass stick to man next in line, who follows suit. This is repeated until all have crossed line and whirled about stick. The first team to have the last man in column originally formed return to line with stick is the winner. Incidentally, the attempt of contestants to keep a straight course when running back to starting line after whirling about stick will be found most amusing.

Circle Games.—In circle games, each team makes up a circle by joining hands and stretching back as far as possible, then dropping hands to the sides. Minimum number on each team, twelve; maximum number, fifty.

Swat Tag.—(Equipment required: Swatter, soft shoe, belt or knotted towel.) The players should stand in circle, heads bent forward and eyes on the ground, keeping hands behind backs. The man first "It" runs about the circle with swatter, and secretly passes it to one of the men standing in circle. The man receiving the swatter at once

turns upon man at his right and swats him with swatter until the man he is beating can make a complete circle around the outside of his team and returns to his starting position. The man holding the swatter then places the swatter in the hands of some other man, and the game proceeds. The players may not strike others upon the head, the small of the back being the most effective place to use swatter.

Lock Arm Tag.—(No equipment needed.) Players are arranged in pairs in circle. The players in each pair lock the inside arms and place the outside arm on hips. There should be a distance of at least three feet between each pair. Two players are selected of whom one is "It" and chases the other. The man who is pursued can link arms with either player of any pair in the circle, whereupon the player at opposite end of the set of three men is subject to tagging. All endeavor, accordingly, to avoid being joined by the man who is pursued, players being allowed to run through or around the circle in any direction. A man upon being tagged may immediately tag back, but after he is attached to any other player may neither tag nor be tagged, unless a third player joins them.

Three Deep Tag.—(No equipment needed.) Players are arranged in pairs, but with each two players standing, one in front of the other, instead of side by side. The game proceeds as in Lock Arm Tag, except that when the man pursued stands in front of any pair, the third man on the outside is subject to being tagged when the pair to which he belongs becomes "three deep."

Broncho Tag.—(No equipment needed.) Players are arranged the same as in "Three Deep." The outside man of the pair grasps the man standing in front of him by the waist, and by twisting him about tries to prevent the man who pursues him from tagging his fellow player. The front man tries to catch and hold the man who is pursued, that he may be tagged instead of the man in front of whom he tries to stand. If the man pursued does manage to stand in front of any pair, the outside man may be tagged by the player who is "It."

Pull Into Circle.—(No equipment needed.) After a small circle is marked upon the ground, players are arranged around the circle facing in with joined hands. At the signal to start, the men try to make some fellow player step inside of small circle with one or both feet. If this occurs, that player drops out. In team competition, the team that eliminates the most men in a given time is declared winner.

Channel Tag.—(Equipment required: medicine ball, basket ball or some other object readily passed, for each team.) Players, arranged in

circle, face to the right, assuming stride-stand position. One player is made "It" and as ball or other object is passed between the legs of the men in the circle, he tries to grasp ball. If he succeeds, the man who touched it last before him becomes "It" as penalty, the man formerly "It" taking his place in the circle. The ball may be passed either backward or forward.

Breaking Prison, Bull in Ring.—(No equipment needed.) Players are arranged in a circle with hands joined. The prisoner takes his place in the center of the circle and tries to get out by breaking the bars (clasped hands) or by going over or under these barriers. Should he escape all other players give chase. The one catching him becomes the prisoner. Prisoners are not allowed to rush more than two strides in attempting to break through the line.

Mount Ball, Rider Ball, Broncho Ball.—(Equipment: one basket-ball.) No. 2s mount astride the backs of No. 1s and are given the basket ball. The riders endeavor to pass the basket ball back and forth. The players they are riding (the bronchos), endeavor, by jumping and bucking, to cause the riders to miss catching the ball. If the ball is dropped upon the ground, the broncho of the player that dropped the ball picks it up and endeavors to hit the rider with it. (Caution—bronchos should keep their positions in the ring. The riders are free to run anywhere to avoid being hit.) If he succeeds, then the riders become the bronchos and the bronchos are given the ball and the game proceeds as before. Heavy men should be paired together in this game.

Tag Games.—In Tag Games the minimum number on each team is six, while the maximum number is fifty.

Ankle Tag.—This game is similar to "Mount Tag" with the exception that a man to escape being tagged grasps another man by either ankle. The man whose ankle is held, however, is liable to being tagged unless he has hold of someone's ankle.

Ostrich Tag.—In order to be safe the player must be standing on one foot with opposite arm under knee of same side, hand grasping nose. This may be made more vigorous by allowing the one who is "It" to take one push at any man in this position and if he breaks his position he is subject to being tagged until he again assumes the position.

Marching Tag.—Two base lines, fifty feet apart. The group is broken up into two units. These units form in company fronting behind their base line, facing each other. Unit No. 1 marches forward in this formation and continues so to march until a whistle is blown.

The whistle is the signal for No. 1 to break ranks and run back to their base line before the men forming Unit No. 2 can tag them. No. 2 man cannot leave their base until the whistle is blown. Every man tagged before crossing his base line must line up with No. 2. Unit No. 2 then marches forward until a whistle is blown and is chased back behind their base line by group No. 1. The line having the largest number of players after an equal number of trials wins the game.

Turtle Tag.—May be played as circle game or otherwise, provided game is kept within suitable boundary space. When pursued by man who is "It," players may gain immunity by dropping to the ground, upon their backs, with feet and hands held upward, turtle fashion. Once out of this position they may be tagged. The man who is "It" has the privilege of running away for four paces and returning, and if the man on ground cannot in that time rise and again resume turtle position, he is subject to pursuit and tagging.

Miscellaneous Games.—In the following games the minimum number on each team is eight, and the maximum number on each team is two hundred.

Line Wrestling.—(Equipment needed: one line marked upon field.) Teams line up on each side of the line, facing each other. Object—to pull the opponent across the line. At the command to go, the men try to pull opponents across the line. When both feet of a man cross the line he becomes a captive and is out of the game for that trial. The team which has succeeded in pulling over the most men at the end of two minutes wins. The best two out of three pulls, to determine the best team.

Battle Ball.—(Equipment needed: basketballs and medicine balls. Two lines parallel and five feet apart.) Competing teams line up behind the line facing each other. A number of basketballs and medicine balls are distributed equally among the two teams. At the signal to go, the balls are thrown at members of opposing team. If a ball touches the individual or if the individual tries to catch it and misses it, it counts a hit for the other. Only one player can be hit at a throw. The team that succeeds in making the most hits during a play period wins the game.

Taking the Trench.—(Equipment needed: two parallel lines, about ten feet apart.) The defenders line up on one of the lines with their backs toward the other line. The object of attacking team is to break through the line formed by the defenders and cross "No Man's Land,"

which is the space between the two lines. As soon as they have crossed the second line, they have taken the trench and can no longer be molested. The defenders endeavor to frustrate the attackers by holding or pushing. (Holding by the clothing is not allowed.) Two minutes is allowed for a try. Every man who has crossed the second line before the two minutes are up, in tending the goal, counts one point for his team. In the second charge, No. 1 changes places with No. 2.

Mount Wrestling.—(No equipment needed.) Competing teams divide according to size. The heavy men carry the lighter men astride their backs. At the signal to go, they meet their opponents who are in a like position and the rider endeavors to dismount as many of the opponents as possible. A dismount is determined when one or both feet of the opponent touches the ground. The team having the most men mounted at the end of a period of play is the winner. Holding by the clothing is prohibited.

Scrimmage Ball.—(Equipment needed: one basketball or medicine ball, two goal lines about forty yards apart and twenty yards long. Side lines to connect the ends of the goal lines forming a rectangular playing space.) The game is started by a forward from each opposing side placing one hand on the ball at the center of the field. Opposing players line up behind their own goal line. Each team is divided equally into forwards and guards. At a signal from the referee the two opponents at the center of the field start playing the ball and the forwards from each team rush into the playing space. The object of the game is to hit the ball with one hand, causing it to touch the ground behind the opponents' goal line.

Foul: It is a foul to hit, push or tackle an opponent, to use both hands on the ball, to throw, kick or block the ball with any part of the body except the hands, to hit the ball while kneeling or lying upon the ground.

Penalty for Fouls: The penalty for a foul is a free try for the goal from behind the penalty mark which is fifteen yards in front of the goal line. One of the offended side tosses up the ball while a team-mate endeavors to hit it over the goal line before it touches the ground. Players of the offending side must line up behind the goal line.

Scoring: If the ball touches the ground behind the goal line it counts one goal and two points are recorded. A foul goal counts one point.

Time: Game shall be played in two halves of ten minutes' duration.

Rules.—There is no off-side play and no out-of-bound. Goal tenders must remain behind the goal line and in tending the goal are allowed to place one foot in front of the goal line. If they step over the goa' line with both feet it constitutes a foul. After each goal the forwards become guards and the guards forwards. The ball is placed in the center of the field and the play continues. As in basketball and similar games, fouls are important.

Steal the Flag.—(Equipment needed: two base lines, parallel and fifty feet apart. A small stick two feet long, which may have a flag attached if desired.) Players on opposing teams line up behind the two lines facing each other. A captain is elected. Each team sends out one representative to the center of the field where the small stick has been stuck into the ground in a vertical position. The object of the two men who have been sent to the center is to grasp the flag and get away behind the base line before he can be tagged by the opponent. If he succeeds it counts one point for his team. If he is tagged by his opponent, it counts one for the opponents. Either man has the privilege of grasping the stick and attempting to return with it to his line. The stick is immediately stuck up in the center field and each captain selects another of his team to send forward to capture the stick the second time. Game continues until each man has had equal opportunity to steal the flag.

Rope Rush.—(Equipment needed: one and one-half-inch rope, twenty feet long, two base lines, parallel with each other and fifty feet apart.) Opposing teams line up behind the base lines, facing each other. The rope is placed halfway between the lines in a pile on the ground. At the signal to start, both teams rush forward and try to get the rope back behind their base lines. The team that succeeds in doing this wins the game.

Black and White.—(Equipment needed: two base lines, parallel with each other and fifty feet apart, a center line parallel with the base lines and halfway between, a pasteboard or wooden disk about four inches in diameter, white on one side and black on the other.) Players on opposing teams line up back to back on each side of the center line with a space of six feet between the lines. One team is called "White," the other "Black." The disk is thrown into the air by the official. If the white side turns up, the "White" team chases the "Black" team across their base line. Every man tagged by the "White" team men, joins the "White" team. The two teams line up as before, the disk is again thrown and whichever side comes up, that team endeavors to

tag its opponents before they can run across their base line. The team having the largest number of players at the end of a game, wins.

Mass Soccer.—(Equipment needed: four to eight soccer footballs. Number of balls determined by number of participants in the game. Game is played on regular football field.) Players on opposite team line up facing each other and ten yards apart at the center of the field in lines parallel to the goal line. The balls are placed on the center of the line on the field between opposing teams. At the signal to start the opposing teams rush forward and endeavor to kick the balls across their opponents' goal line. The same rules which applied to soccer football as to personal contact and as to playing of the ball, apply here. If a team succeeds in kicking one of the balls across their opponent's line, it counts one point for that team. If the ball crosses the goal line between the goal posts, two points are accorded the team. In either case that ball which has been kicked across the goal line is brought to the center and kicked off again by a player of the team scored against. The game continues until all the balls have been put out of play, each having been kicked across either of the goal lines. If the ball has been kicked outside of the field of play, the referee blows his whistle. He then picks up the ball and throws it into the field of play at the line at right angles to the side line and for a distance of at least ten feet. It is necessary to have as many officials as there are balls. A foul is penalized by giving the opposing team a free kick at the point where the foul was committed. The defending team must keep at least ten feet from the ball during the free kick. Exception—if the ball is nearer the goal line than ten feet, the penalized team may line up halfway between the ball and the goal line. There should be a judge for each ball and a scorer on each line. A judge shall report to the scorer whenever a goal is scored by the ball he judges. There shall be a referee who shall have the same authority as the referee in soccer.

Tug-of-War.—(Equipment needed: One half-inch rope, sixty to one hundred feet long. The center of the rope is marked by a tape or string. Six feet on both sides of the center the rope is marked by other pieces of tape.) Opponents are lined up at each end of the rope (they are not allowed to grasp it beyond the six-foot mark, nor are they allowed to tie it about their bodies.) The center of the rope is placed over a mark on the ground. At the signal to pull, the teams endeavor to pull their opponents across the center line. If before the end of two minutes a team has succeeded in pulling the rope

so that the six-foot tape on their opponents' side of the rope crosses the center line, that shall count as a victory for that team and pull ends.

Cane Rush.—(Equipment needed: a number of small sticks or short pieces of rope about three feet long, two base lines, fifty feet apart.) Opposing teams line up beyond the base line, facing each other. The short canes or ropes are placed in the center of the playing space halfway between the two base lines. At the signal to start both teams rush forward and endeavor to bring as many of the canes or strings behind their base line as possible. At the end of playing time, the team which has succeeded in bringing the most of these home, wins.

Dual Wrestling.—(No equipment needed.) Teams line up for dual competition with a short man in front of the column. Arrange men in columns with not over ten men in each column. The first man in the column steps out and wrestles, endeavoring to make his opponent touch the ground with some part of the body other than the feet. If he succeeds it counts one point for his team. The two men take their places at the rear end of the line and the second two men step out and wrestle. This is continued until all the men have competed. The team having the largest number of points at the end of the contest wins. (Winners in each column can be matched in a final if desired.)

Push Across Line.—(No equipment needed.) Two lines about twenty feet apart. In the center of the lane thus made the two teams are placed in line facing each other. At the signal to go each man tries to push his opponent back and across his opponent's line. At the expiration of one minute, time is called and the squad having pushed the largest number of its opponents across the line wins.

Rest Games.—These games may be used between strenuous active games for the purpose of resting the players. The game can also be used indoors as a means of social entertainment.

Buzz.—(No equipment needed.) Players are grouped around the leader in a ring. The leader has the players start counting. If it becomes the player's turn to count seven, some multiple of seven or a number with seven in it, that player must say "Buzz" instead of the number. The penalty for not doing this is dropping out of the circle. The counting will continue so long as there are players in the game.

"Kelly Says."—(No equipment needed.) The players are grouped about the leader or in military formation. The leader gives the com-

mands, preceded by the words "Kelly says." Example: "Kelly says, Right Face; Kelly says, Be Seated." If the leader leaves out "Kelly says" before any of his commands, the command is not to be executed. The player answering such a command drops out of the game. This game is very popular with soldiers and can be used with the manual of arms.

Passing the Buck.—(No equipment needed.) The players are in formation of two or more files, standing at stride-stand position with forward body-bend and hands upon hips. Upon the starting signal the back man comes to the position of attention—with a snap—at the same time striking hard with the open palm of both hands the seat of the man in front of him, who in turn "Passes the Buck" on down the file. When the file-leader receives the "Buck" he immediately gives the command, "About face"—the file about faces and jumps to a stride-stand forward trunk-bend and the "Buck" is then passed up the file harder and faster than it went down. This is a relay race and the file getting the "Buck" back to its file-closer first, wins. It is advisable to repeat the relay, *i.e.,* have the "Buck" passed down and up the file twice.

Strength Tests.—Large groups of men can be divided into equal smaller groups and compete in the following events to good advantage. These events can also be used successfully as events for stunt night programs. Have the winner challenge anyone in the audience.

Hand Wrestling.—(1) The wrestlers stand with right foot advanced clasping right hands. The object is to make opponent move a foot from its position, on the ground. This constitutes a throw.

Toe Wrestling.—(2) The wrestlers are seated on the ground facing each other. A stick is placed between the arms and knees while in this position. The object is to get the toes under those of the opponent and roll him over backwards. If either wrestler breaks his hand-clasp about the knees it constitutes a victory for his opponent.

Indian Wrestling.—(3) The wrestlers lie upon their backs, side by side, with arms locked, legs extended in opposite directions. The right legs are raised and lowered twice. At the third raising they lock legs together and each endeavors to bring his opponent's leg down to the ground thereby turning him upon his face.

Pull Stick.—(4) .Two sit upon the floor, toes against toes. They grasp a broom handle between them and at the signal each tries to pull the other up off the floor. Can be used without stick by opponents grasping hands, using hook grasp.

Twist Stick.—(5) Two grasp a gun or broom handle high above their heads. At the word to go the stick must be brought down between them, thereby twisting within the hands of one of the players. This can be done without stick by having opponents grasp hands above head, fingers between fingers.

Cock Fight.—(6) A circle four feet in diameter is drawn upon the floor or ground. Two players standing on one leg, both hands grasping the other foot behind their backs, endeavor to make the other step outside of the ring or break his clasp upon the up-held foot, by shouldering each other.

Dog Fight.—(7) Players, in pairs, place themselves on hands and knees facing each other about three feet apart. Their leather belts are linked together. The linked belts are thrown over their heads. The players must keep heads up and back. At the word go, the players pull against each other until one of them is pulled across the line, three feet back from where the players started, or until his head is pulled forward, thereby releasing the strap.

PART 11

EXERCISE FOR WOMEN

ALL that has been said throughout this entire work in regard to the value and importance of bodily strength and all-round physical vigor, applies as much to women as to men Indeed, one may say that physical strength and rugged health are, if anything, even more important in the case of the so-called weaker sex, because of the heavier burdens which women have to bear in the natural course of life. It is true that these burdens are not always in evidence in the case of those supposedly fortunate but truly unfortunate women who live the pampered, parasitic existence of idle and luxurious wealth. But for the average housewife and mother, whose labors are not limited by special working hours, as is the case of the father of the family, these burdens are such as to demand the most perfect physical condition. But more than this, since woman bears the children, the very life and energy of the race depends upon her and her health. From a vital and biologic standpoint, therefore, we can least of all afford to neglect the question of the health and physical development of women.

The day has gone by when it was considered that frailty, either in a physical sense or in its reference to character, was the essential quality of womanhood. We know now that the designation "weaker sex," as applied to women, was an unpardonable libel against the sex which there is good reason to believe is the more vital and enduring of the two. We know now that the apparent and superficial muscular weakness of woman has been the result of artificial conditions which have been forced upon her, and that the old conception of her was a result of the general misunderstanding of this fact. We know now that when placed in a natural environment, with the possibility of full development, woman is no less strong and enduring than man, a fact which has been amply proved by the physical stamina of women in various savage tribes where conditions have favored something like equality of development.

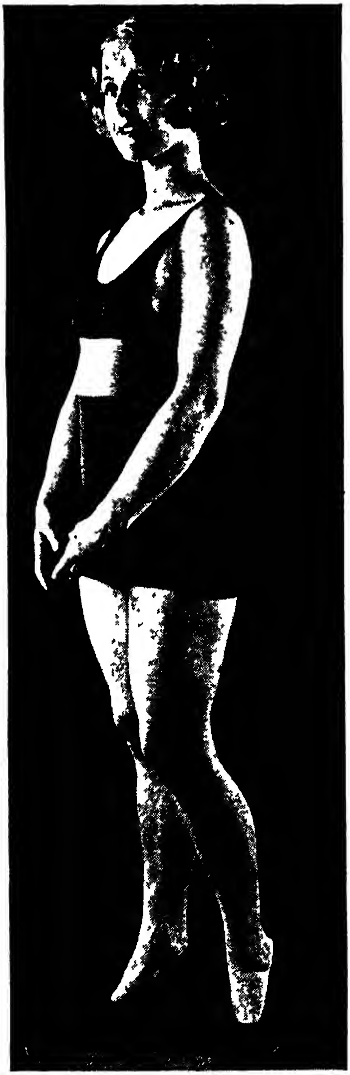
We know that in spite of the physical handicaps which women have endured in the past, and the burdens which they have carried,

probably a larger number of them have lived to extreme age than of men, indicating their innate vitality and power of endurance. And from a biologic standpoint we should really expect this to be the case. Scientifically speaking, the female was the only sex in the beginning, and for a long time the only sex. Nature apparently intending that it should be the predominating sex at all times. The male spider is insignificant in comparison with the female, both in strength and size. It is so with many other insects. Among most species of fish the female is the larger and better developed. The female eagle is more powerful than the male. Among most animals, it has been the tendency of the males to fight for the possession of the female that has gradually developed in them a superior muscular strength. In the human race, artificial conditions and the perverted ideals of womanhood which have endured for a long time have been responsible for the superficial feminine weakness of the past. Even in spite of this, and without the advantage of the physical training which women have taken up in recent years, many women have at various times demonstrated their physical fitness to cope with men in their own specialties.

But the athletic girl is fast becoming the ideal, and the world generally is gaining a more wholesome conception of the meaning of perfect womanhood. Both men and women are learning that the subtle charm of womanhood is the result of the superb physical magnetism of robust health, and that without this vitality, this physical basis of true womanhood, no woman can be more than half of her real self. Furthermore, women are coming to realize that exquisite personal beauty is almost entirely a matter of health and development. Beauty is the expression of a vigorous and harmonious condition of the entire body, of internal cleanliness and wholesomeness, all of which are absolutely inconsistent with a condition of weakness or the physical inactivity which is responsible for such weakness. Pure blood and a good circulation are impossible under conditions of muscular stagnation, involving also a lack of tone and the sluggish action of the functional organs. The beauty lines of any part of the body depend upon the muscular efficiency of that part. If muscularly strong and competent, the lines will be those of grace and symmetry. If weak, awkward and incapable, the lines will be those of ugliness. It is the muscular formations underneath the skin which give character and contour to any part, the decided muscular structure merely being smoothed off by a superficial deposit of fat. A body formed chiefly

of fat, and lacking in the substructure of muscle, is flaccid, shapeless and altogether ugly, and cannot possibly be otherwise.

This section takes up matters of special interest in the physical training and development of women, with some special exercises of peculiar value to the sex. However all that has been said elsewhere in regard to exercise and its essentials applies to women as well as to men. The class drills and calisthenic exercises offered in another place are recommended for the uses of women as much as for men, and will prove adequate for all purposes of general development. The various subjects treated here are taken up in alphabetical order so far as this is practicable.



While good posture requires erectness of the figure it is desirable that stiffness be avoided and a free and natural position of the body maintained.

Carriage, Grace and Poise.—The importance of an erect carriage and of good bodily poise cannot be overestimated, and especially so in the case of women, among whom the consequences of poor carriage and the concomitant prolapsus of internal organs are much more serious than in the case of a man. The human body is built along such lines that it is properly efficient and at its best only when it is erect. Any deviations from the correct attitude inevitably lead to derangements or disorders detrimental to the entire body.

It may be said that the first essential for securing an erect carriage is a high degree of vitality and vigor of the entire body, and of the back especially. It is the muscles of the back which are directly and immediately concerned in maintaining a normal position of the spinal column. Vitality and constitutional vigor are essentials.

It is sufficient to look at anyone who has a surplus of vital energy, who carries about with her the suggestion of reserve power in abundance, and who is magnetic and commanding in personality because of this physical energy and vitality, to note the effect upon the carriage of the body. In her exuberant health you will see that she stands erect, that she holds her head up with an unconscious grace and strength, that her bosom is high and full, and that she treads the earth with a step so light that it would seem that she weighed nothing at all. On the other hand, note the languid attitude of the sickly one, the natural attitude, without the support of corsets and braces which hold her stiffly and awkwardly almost erect. Her entire upper body is in a slump, with drooping, perhaps rounded shoulders, chest contracted, the naturally beautiful arch of the back almost straight, the abdomen protruding and all of the internal organs sagging inches below their normal position. Her entire physical attitude is suggestive of her lack of vigor: is a concrete expression of her physical self. It is not sufficient in her case to suggest that she stand erect, and it is not even sufficient for her to take one or two special exercises for improving her carriage, though such exercises will accomplish much; but in order to enjoy a perfect carriage and that exquisite physical poise which means charm and grace, she must build health and strength of the body in every way. She must acquire that superb degree of vitality which in the case of the other woman expresses itself unconsciously in the grace and poise of an erect but easy carriage.

If the reader will refer to Part 1, pages 45 to 176, upon the construction of the human body, it will be observed that the organs lie close together, some entirely surrounded, others bounded by the diaphragm, the ribs, the walls of the abdomen, or by the pelvis; several of them are suspended from the spinal column. The organs are many, because the various processes necessary to conduct properly the various functions of so complex a mechanism require such a large number; they are closely compact because of their necessarily limited space and because their functions are so closely interrelated. Yet, when the spine is erect and the trunk free from constrictions, they have ample room.

An automobile, or a watch, or any other piece of machinery will not continue to function properly if one side of it "buckles"—if it is folded upon itself. The human machine is composed of fairly soft structures, it is true, but these structures cannot function much more effectively than can the various parts of the other machines when

they are pressed against one another and squeezed against restraining walls. But this is exactly what one does when he slumps or fails to hold the body erect: the organs are crowded into still smaller space. They are normally prepared to do their very best work only when in their natural positions, and the crowding and straining which they endure in a prolapsed condition interfere most seriously with their duties, as well as with the circulation of the blood through them. And to a very large extent the multifarious weaknesses and disorders peculiar to the female sex are due directly to the weakness and prolapsus which follow improper carriage.

Physical vigor expresses itself in an erect attitude, and proper posture tends to encourage and develop vigor, because of the advantage under which all of the functions and activities of the body proceed. There is less fatigue, with a conserving of the vitality which is otherwise needlessly wasted. Therefore, every woman should make a special study of the requirements of good carriage, and should keep to the erect form in sitting, standing and walking. It is really no harder to sit and stand properly than improperly, and if you think it is, then you have not the proper poise. As soon as you are accustomed to this, you will find it easier than the incorrect attitude, and you will be able to do much more work with less effort. Remember that there should be no strain in any part. Do not go about continuously trying to pull your shoulders too far back, and do not make the mistake of pulling the shoulders upward; they should be back, but *down,* and this will have the effect of raising the chest, also keeping the abdomen within proper bounds. It needs hardly be said that a vigorous condition of the muscles of the region of the stomach and pelvis will help materially in maintaining a normal attitude of the torso, but one should give special attention to the development of the back, shoulders and chest.

High-heeled shoes have been referred to elsewhere, but are mentioned again because of their special influence in disturbing the proper carriage of the body. Their tilting up influence throws the entire upper body out of plumb. The original construction of the feet by Nature cannot be improved upon, and the nearer we get to the flat heel of the moccasin the better for good carriage.

All general exercises which develop the body and train the muscles are of indirect value in improving the carriage and in promoting grace.

Sitting correctly is just as important as standing properly and this exercise may be executed sitting down equally well, and with the greatest advantage. In each case the important thing is the upper

body, or torso, and the general attitude of this should be the same in sitting as in standing. It will often help if one foot is drawn back under the chair and the other extended a bit forward on the floor. In this position of the feet you will be able to arise and sit down without bending far forward.

It should be remembered that the spinal column is not straight like a broomstick, but that it has a decided arch inward at the small of the back. Much is said about a "straight back," but the expression has reference to a back that is not humped or rounded at the shoulders, and in strapping his papoose to a board it was the idea of the American Indian to avoid such tendencies. The arch of the back referred to aids in giving the spine its elastic or spring-like quality, and helps to take the jar of walking or jumping away from the brain. Indeed, the spine has a double arch, another at the upper part, the entire line not unlike that of a letter "S" with a modified curve. Now, in either sitting or standing, if the lower part of the back is straight, the chest is necessarily thrown forward and depressed, while the abdomen is thrown forward and upward, the whole attitude being ugly and unhealthful. With the back arched inward, both chest and abdomen take their proper places, and the general lines are those of beauty. This position should not be exaggerated, but if one will think of the small of her back when sitting and see that it is properly arched in this way, she will find that her chest will take its proper position, and that the entire body will have an erect, graceful carriage.

Dancing.—See under *Beauty and Personality Building,* Part 12 of this volume.

Height and Weight in Women.—It has been generally conceded that a woman normally carries a larger percentage of fatty tissue than a man. It has been suggested that this is a provision of Nature which permits her a greater reserve of nourishment for the ordeals of child-bearing and nursing. Another explanation may be found in woman's greater tendency toward a less active and therefore less muscular life than man's. Being less muscular, she obviously will appear unduly thin unless she is fatter than a well-muscled man.

Already the new generation of athletic girls is proving that a woman may be beautifully formed by muscular development without any undue fat. She can be well-muscled in proportion to her size and skeletal form, without losing any of her essential feminine curves and grace. Such symmetrical, muscular bodies as are seen in many dancers and swimmers are now being appraised as the ideal of feminine

beauty. However, women who have not been able to carry on such activity may need a somewhat larger proportion of fatty tissue than a well-muscled man would carry. Such women are justified in carrying enough fat for this purpose, and it is better to do so than to go to the opposite extreme of eliminating all fat by too strenuous reducing methods. The weight increase from this fat permissible for appearances would rarely need to be over ten to fifteen pounds, which is well within the weight of variation which statistics show to have no appreciable effect on susceptibility to disease or length of life.

It is not necessary from the standpoint of either beauty or health that the body should be entirely free from fatty deposits. In an emaciated and undernourished person the skin is thin and appears to stretch too tightly over joints and muscles. Normally it is backed by a thin layer of fat which softens it and gives the body smoothness and grace. But this fat should never become so thick as to hide the form of the muscles beneath. These distinctions are most readily noted on the abdomen, where fat most frequently accumulates. When the abdominal muscles are relaxed this may not be noticed, but if they are tensed the thickness of the fat layer is apparent.

Clothing disguises the distinction between fat and muscle, but the nude body readily shows to what extent fat has covered or replaced muscular tissue. Instead of the smooth, even swell of muscles beneath a thin, healthful layer of subcutaneous fat, increased fatness brings shapeless lumps and unbeautiful contours. The ideal body has just enough fat to round out the sharper angles, fill in depressions and give the skin a live, beautiful texture quite different from the inert appearance of skin overlying fat deposits. This condition of unsightliness increases with the age of the person and the age of the fatty deposits. During youth considerable fat may be carried and yet the body will seem fairly symmetrical. But once the fat begins to accumulate in lumps unsightliness soon follows.

While weight is a matter of health and good condition, height has no such close relation to physical and mental well-being. It is largely an individual matter.

Even in children heights vary considerably at the same age. Whether or not height is normal, other measurements must be considered in relation to the particular height of the individual. Readers of both sexes may find the weight-for-height tables, based upon Insurance Examination records, and appearing in Part 2 of this volume, interesting in this connection.

This form of table merely states average fat accumulation and is not a logical ideal for physically vigorous persons. All it means is that men and women continue to accumulate fat with the years and so show, on an average, a gain of three to four pounds every five years.

Between the ages of fifteen and twenty the gain of ten pounds for boys and six or seven pounds for girls may well be due to the completion of growth in boys, and in the case of girls, to the rounding out of the feminine form as against the "boyish" form of immature girlhood. But beyond the age of twenty for girls and twenty-five for boys the weight added is generally nothing but fat.

However, men may continue to grow and develop muscle many years longer than women ordinarily do. Part of this tendency is inherent in the sex difference and part of it is due to the more frequent muscular occupation of men. Years of observation have resulted in the discovery of numerous cases of men who, though mere striplings at twenty, have been muscular giants at thirty, or even forty. But with women the far more common development after twenty is an accumulation of fat.

Women usually reach their full height at about the age of seventeen. At eighteen and twenty not only has the full height been attained but the muscular development is equal to that of the home-keeping woman of maturer years. The few professional women swimmers and athletes may not reach their maximum muscular growth or general bodily development until a later period. But an astonishingly large proportion of women record-holders in swimming and other athletic sports are girls of seventeen to twenty.

Far from continuing any real growth or muscular development throughout middle life, we know that the opposite effect is true. We encourage athletics and outdoor life for our girls in their teens and early twenties; and then they settle down, to let their muscles decay while they take on fat. There are exceptions, of course, but there are not enough active and athletic women to affect the average figures.

Therefore we know that the weights shown in insurance tables, although they indicate a weight increasing with the years, represent less muscular development than that of girls of twenty. The added weight is simply fat, and it has no excuse for existence. If there is to be any change in the weight of the average woman as she goes through middle life it ought to be a slight decrease as her muscular development deteriorates. Of course, it shouldn't be allowed to decay, or at least not before fifty, but in practice it usually does.

Even if the form of the athletic girl of twenty is taken as the standard of women's form at any age, we would still have to excuse a little excess of fat to replace shrinking muscles.

However, we must permit that excuse. It would mean too much of a fight against even our present conceptions of feminine beauty to forbid women with poor musculature from counterfeiting the absence of muscles with enough fat to fill out Nature's ideals of bodily form and beauty.

There is good reason to ridicule the absurd caricatures which fashion artists love to draw—impossible creatures on giraffe-like legs, with long, tapering ankles, who, in accordance with their other proportions, would be eight feet tall.

But neither the folly of those who try to reduce without reason, nor the absurdities of fashion artists, should be used as an excuse to return to the older order of tolerating obesity and calling fat girls "plump" and fat matrons "stylish stouts." The ideal feminine form is best represented by the combined effects of youth and athletic activities, and there is no known law of health or art to explain why age should increase either the girth or weight of the older feminine form over that of full-grown and fully developed girlhood.

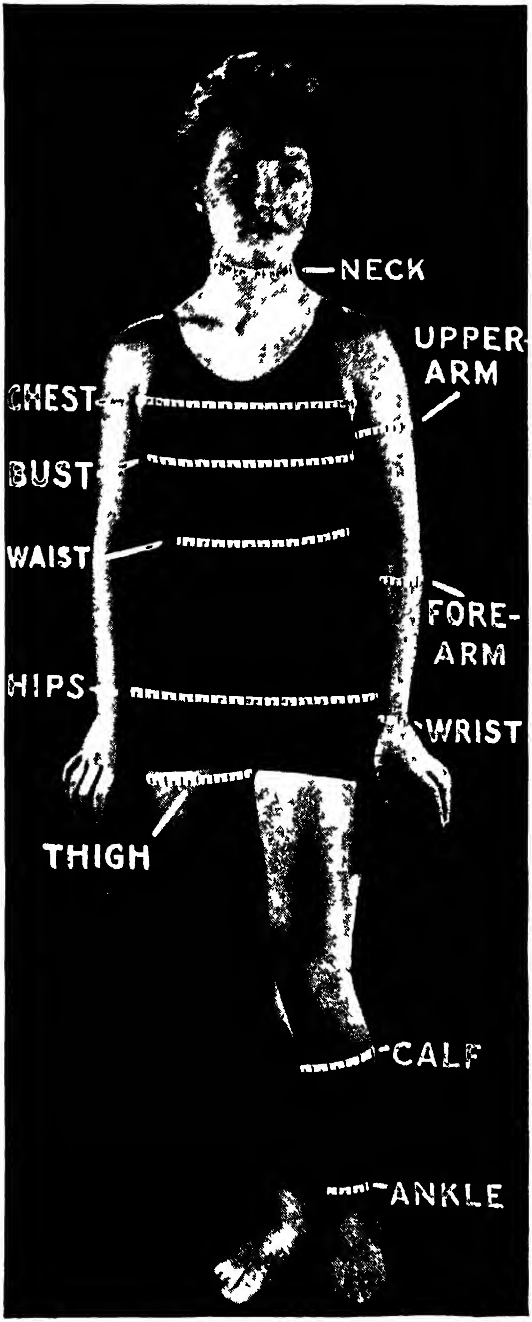
Far from being the curveless creature of the fashion drawings, the normally developed woman is a truly feminine figure, well rounded and well curved. Her hips, instead of being invisible, are from nine to eleven inches, and her bust from six to seven inches, larger than her waist. She is distinctly feminine in every detail, and anything but boyish in form. But she is differentiated from masculinity by the grace of feminine contours and curves, and not by flabby fatness that makes her waist pudgy, her ankles puffy and her hips wobbly.

The inexcusable folly of setting standards of increasing weight with the years has been noted by many, and a number of health writers have attempted to derive better standard weights than in these old tables. One of the most frequently stated conclusions is that the weights at the age of thirty should be accepted as standard weights for women at all ages.

Having once and for all eliminated the old error of basing weight standards upon the mere average of existing weights, the true relation of weight and height can be considered. All heights, for this purpose, are taken without shoes, and weights are taken in bathing-suits.

The following tables of weights for heights form a basis for further discussion. In the second column is given the new Physical Culture

In taking women's measurements, care in placing the tape is even more important than in taking men's measurements. This applies especially to the bust, to the waist and to the hips. This is chiefly because, on account of the greater curves in a woman's physique, misplacing the tape by an inch or two might give quite a wrong idea of the woman's proportion and degree of development. The neck, wrist, waist, and ankle measurements are the smallest that may be taken in each region. The bust, chest, forearm, hips, thighs, and calf measurements are taken at the largest points of each region indicated.



Standard as derived from the scientifically calculated ideal weights of some four hundred contestants entered in the Physical Culture Beauty Contest whose complete measurements have been analyzed.

For comparative study the average weights of the old tables are also given for the ages of twenty and thirty. These need no further explanation. The last two columns do not show actual weights of any groups of real people, but are theoretical standards based on two types of calculations. These figures will serve as reference tables to help you understand some interesting laws that govern the relation of height to weight.

WEIGHT-TO-HEIGHT PROPORTIONS IN WOMEN

Height in Inches	Physical Culture Weights	Average Weights 20 Years	Average Weights 30 Years	Two Pounds per Inch Weights	Uniform Proportion Weights
58	107 lbs.	109 lbs.	115 lbs.	116 lbs.	92 lbs.
59	109 "	111 "	117 "	118 "	97 "
60	111 "	113 "	119 "	120 "	102 "
61	114 "	117 "	122 "	122 "	107 "
62	117 "	120 "	125 "	124 "	112 "
63	120 "	123 "	128 "	126 "	118 "
64	124 "	126 "	132 "	128 "	124 "
65	128 "	130 "	136 "	130 "	130 "
66	132 "	134 "	140 "	132 "	136 "
67	136 "	138 "	144 "	134 "	142 "
68	140 "	141 "	148 "	136 "	149 "
69	144 "	145 "	152 "	138 "	156 "
70	148 "	149 "	155 "	140 "	164 "

The weights in the fifth column are easily explained. They are derived directly from the height, by the rule of thumb that a woman should weigh two pounds for each inch of height. It is a remarkable coincidence that the woman of the ideal height, as well as of ideal weight, does happen to come very close to fitting this rule of two pounds for each inch in height. The average height of white women, without shoes, is sixty-four inches (five feet four). But since exceptional health and growth in childhood tend slightly to increase the height, it is not at all irrational to conclude that a height a little more than the average should represent the ideal of woman's stature. If the height of sixty-six inches is doubled, one gets the figure 132, which

inspection of the table shows to coincide with the ideal weight for this height in our first column.

Once one gets such a rule in mind it is easy to apply it in all cases and to accept even those of other heights whose weights conform to it. There is a considerable leeway in such matters, however, and individual women may be well formed and beautiful within quite a weight range, provided their weights are based on real development and not on the presence or absence of fat.

Therefore, even though the rule of two pounds per inch of height does not properly apply except at one height, yet shorter girls when more fully muscled, or taller girls when graceful and slender, may be beautiful individuals and still conform to this rule within a range, say, of from sixty-three to sixty-eight inches in height.

But it is also obvious, when these weights so figured are compared with the facts of the mean or average weights as derived from large numbers of real figures, that the rule of two pounds per inch in height sets too heavy a standard of weight as the height decreases and too light a standard of weight as the height increases.

Size and Weight.—The weight of any body of like substance is determined by its volume or actual size. The weight or volume of any object cannot vary directly in proportion to any one dimension unless the other dimensions remain the same. Thus if you have a block of substance one foot square and one foot high you will have one cubic foot. If it is very light wood such a block may weigh twenty-four pounds. Then a block one foot square and five feet high will contain five cubic feet and weigh 120 pounds. For every inch increase in height such a block would increase two pounds in weight. The weight therefore varies with the height—provided the other dimensions remain exactly the same.

So if this rule of two pounds per inch were to apply to women of all heights, their body girths and breadths would have to remain the same at all heights. Obviously they do not and should not. Yet, as we shall find out a little later, body girths do not increase with an increase in height nearly so rapidly as one might at first suppose. This enables us to answer the interesting question as to whether the ideal form of the adult woman's figure is the same at all heights. If it were, then equal-sized photographs of the perfectly formed short girl and the ideally formed medium and tall girls would all look exactly alike.

This question brings us to the figure in the last column of our table,

because these figures give the weights for the heights as they would be if the relative proportions of the body were exactly the same at all heights. Comparing these figures with those derived from actual living women, we see at once that typical short and tall women cannot be the same in form and proportions.

If you have been observant you have noted that fact from real life. Short women are relatively more heavily set or broader in relation to height than tall women. The same is true, of course, for men.

But this applies to the short and tall individuals of a given race. When we compare radically different races, as, for instance, the shorter Japanese race with the taller American type, we find that the Japanese not only look short to us but they look small. And they are smaller. They are little people, not merely short people. A Japanese woman is built in proportion to her height, whereas the American woman who is as short as the average Japanese woman is not of the same proportions as a taller woman, the American woman being proportionately somewhat heavier.

This same element of unusual attractiveness in the merely diminutive creature who is small in all dimensions and yet retains the proportions of the ideal feminine form of average height is found in exceptional and unusual women of our own race. Such women look doll-like, petite and graceful.

On the other hand, a woman who is exceptionally tall and who retains the same proportions throughout as those of the ideally formed woman of medium height is also a very striking figure. If a woman of seventy inches (five feet ten) is not fat but symmetrically large throughout, she impresses us as a giantess. She is powerful looking, she is stately, and she is really beautiful; but men do not call her pretty and she may fail to attract them because she overawes them. But that is merely because men prefer smaller women to give them a sense of superiority. Indeed, the whole of human civilization would be vastly changed if women were as large and powerful a creature as man.

But we are dealing here with a hypothetical idea of woman's figure being of the same form and proportion at all heights. Only the exceptional and unusual individual of our race is so formed, and it would not do to set up such unreal standards as ideal proportions. It is not merely a matter of fatness that makes the short woman relatively more broadly built or the tall women relatively more slender. The difference is more fundamental than that, for this more chunky or

more slender form of the shorter or taller woman is evidenced also in the skeleton, the muscles and the vital organs.

Therefore, for the typically built short woman to attempt to reduce to the weights shown in the last column of our tables would mean starving herself till all fatty tissue was gone and her muscles looked too bare and her bones too large, while her general state of nourishment would be too low for the maintenance of health. On the other hand, for very tall women to attempt to reach such proportions would merely invite the accumulations of fat, since only a few develop so much muscle.

If you will make one more comparison of the figures in these tables you will note a rather interesting fact. In the fifth column is shown what the weights of women would be if they actually varied only two pounds per inch in height. Now if you will note the last column again, you will see that if women of various heights actually remained of the same proportions they would vary about six pounds per inch in height. But one referring to the figures in the first three weight columns, which are based on real cases, will note that the actual variation is about four pounds per inch in height, or just about halfway between these two other theoretical relations of height to weight.

Another way of putting it, for those who are mathematically inclined, is to state that the actual weights do not vary directly with the height nor with the cube of the height, which would give exactly the same proportion, but approximately with the square of the height. This law was worked out by an Austrian scientist when allotting food to war-starved children whose rations were assigned in proportion to the square of the sitting height and was found to be remarkably accurate, resulting in just the right relative amount of food for the children of different sizes.

Basis for Ideal Proportions.—While it is believed that the physical culture weight-for-height standards are the best yet published, they should not be taken as an absolute rule by which to determine ideal weights. They will merely show whether one is above or below the weight of the typical candidate in a beauty contest. While this is very interesting and informative it does not finally settle the question as to what would be the ideal weight for any particular individual.

The bony framework varies in relative weight. Muscular development also varies quite widely, though not as much in women as in men. Exact rules about such matters cannot be given, and readers can only be cautioned to adapt their weights to their own physical peculi-

arities. The human eye and human touch are required to recognize that ideal condition in which an evenly distributed coating of fat rests upon the right combination of muscular tissue over the bony framework of the body.

This further caution is also needed: no woman should excuse obesity on the grounds that she is naturally heavily built. That common illusion is often easily punctured by recalling one's schoolgirl form. The woman who was lithe, graceful and fine-boned when she was in her late teens has no right to talk about being "just naturally broadly built" because she has accumulated fat in her forties.

Girth Measurements.—The question of body girths or the tape measurements in relation not only to height and weight, but of one part to that of another, may now be considered. For instance, you may want to know if your waist or hips or thighs or calves are relatively too large or too small for the other body girths. These standards have been accepted in many past instances on bases even more inaccurate than weight standards.

In fact there has been no standard at all based on real measurements of well-developed athletic young women. There are measurements purporting to be derived from the classic figures of art, but there is no logical agreement among them. Also, nearly every woman heralded to the public as the winner of a beauty prize has had someone take her measurements who declared them to be those of the "Modern Venus" and therefore a law of form and proportion for all women. Of course, such a conclusion is wrong.

From the ample data provided by the actual measurements of several hundred beauty-prize contestants, it has now been possible to work out the true relations of all such measurements to height, to weight and to each other. By these standards you can now check your own relative proportions.

Girth measurements do not vary as much as heights. The typically formed woman 60 inches in height does not have a bust measurement of 30 inches and the girl 70 inches in height a bust measurement of 35 inches. With the same relative degree of muscular and fatty development, the actual variation is only about half as much as it would be if girths were exactly proportionate to the height. Indeed, girth measurements vary so little with height changes that one is quite likely to find plenty of 37-inch hips in women of both 60 inches, and 68 inches in height. That does not mean that either measurement is ideal. A 37-inch hip is the ideal for a woman whose height is 64 inches and whose

weight is 124 pounds. The woman with this typical height and weight is the basis from which the relative ideal measurements for other heights and weights are derived, and so the ideal girths for such a woman will be given first.

STANDARD MEASUREMENTS FOR WOMAN 64 INCHES IN HEIGHT, WEIGHING 124 POUNDS

Neck	12½	inches	Waist	26¼	inches
Upper arm	11	"	Hips	37	"
Lower arm	9¾	"	Thigh	22¼	"
Bust	33½	"	Calf	13½	"
Ankle	8¼	inches			

General Female Proportions.—Starting from this set of ideal measurements for the woman of average height and in an ideal physical condition, a full table has been worked out for weights and corresponding measurements for women from fifty-nine to sixty-eight inches in height. As in the similar table for men, four weights are given under each height. The classes are very differently labeled, however, in recognition of the fact that women are more concerned with weight control than with any unusual muscular development. The four classes may be defined as follows:

"Slender," which designates the first degree of weight and development, is somewhat underweight and underdeveloped from the standpoint of what we deem to be the ideal of health and beauty for women. This degree of development, as the term "slender" indicates, pretty well expresses the feminine form that became so fashionable in America in the decade following the World War. Indeed, it represents very closely the weights and measurements found in the most sought-after clothing models of that period.

"Ideal" scarcely needs further definition, as it represents our nearest approach to both health and beauty in the female body when our ideas are not biased by fashion.

"Plump" represents a degree of overfulness of form that is just about as much above the ideal as the fashionable slender form is below it. Yet this degree of plumpness was at one time quite as fashionable as slenderness later became.

The range of weights and measurements from the slender to the plump may be considered as the outside range of forms wherein health

WEIGHTS AND MEASUREMENTS FOR WOMEN OF VARIOUS HEIGHTS AND OF VARIOUS TYPES OF DEVELOPMENT

Height in Inches	Type of Physique	Weight in Pounds	Neck	Upper Arm	Lower Arm	Bust	Waist	Hips	Thigh	Calf	Ankle
59	Slender	102	11¾	10	8¾	31	24¼	34¼	20¼	12¼	7¾
	Ideal	109	12	10¼	9	32	25	35¼	21	12¾	8
	Plump	116	12½	10¾	9½	33	25¾	36½	21¾	13¼	8¼
	Overweight	122	12¾	11	9¾	34	26¾	37½	22½	13¾	8½
60	Slender	104	11¾	10	8¾	31¼	24½	34½	20½	12¼	7¾
	Ideal	111	12	10¼	9	32¼	25¼	35½	21¼	12¾	8
	Plump	118	12½	10¾	9½	33¼	26	36¾	22	13¼	8¼
	Overweight	125	12¾	11¼	9¾	34¼	27	38	22¾	13¾	8½
61	Slender	107	12	10¼	9	31½	24¾	35	20¾	12½	7¾
	Ideal	114	12¼	10½	9¼	32½	25½	36	21½	13	8
	Plump	122	12¾	11	9¾	33½	26¼	37¼	22¼	13½	8¼
	Overweight	129	13	11¼	10	34¾	27¼	38¼	23	14	8½
62	Slender	109	12	10¼	9	32	25	35¼	21	12¾	8
	Ideal	117	12¼	10½	9¼	33	26	36¼	21¾	13¼	8¼
	Plump	125	12¾	11	9¾	34	26¾	37½	22½	13¾	8½
	Overweight	132	13	11½	10	35	27¾	38¾	23¼	14¼	8¾
63	Slender	112	12¼	10½	9¼	32¼	25½	35½	21¼	12¾	8
	Ideal ..	120	12½	10¾	9½	33¼	26¼	36½	22	13¼	8¼
	Plump	128	13	11¼	10	34½	27	37¾	22¾	13¾	8½
	Overweight	136	13¼	11¾	10¼	35½	28	39	23½	14¼	8¾

WEIGHTS AND MEASUREMENTS FOR WOMEN OF VARIOUS HEIGHTS AND OF VARIOUS TYPES OF DEVELOPMENT (*Continued*)

Height in Inches	Type of Physique	Weight in Pounds	Neck	Upper Arm	Lower Arm	Bust	Waist	Hips	Thigh	Calf	Ankle
64	Slender	116	12¼	10½	9¼	32½	25¼	35¾	21¼	13	8¼
	Ideal . . .	124	12½	11	9¾	33½	26¼	37	22	13½	8½
	Plump . . .	132	13	11½	10	34½	27¼	38	22¾	14	8¾
	Overweight	140	13½	11¾	10¼	35¾	28¼	39¼	23½	14½	9
65	Slender . .	120	12½	10¾	9½	32	25½	36¼	21½	13¼	8¼
	Ideal . . .	128	12¾	11	9¾	34	26½	37½	22¼	13¾	8½
	Plump . . .	136	13	11½	10	35	27½	38½	23	14¼	8¾
	Overweight	145	13½	12	10½	36	28½	39¾	23¾	14¾	9
66	Slender	124	12½	11	9½	33	25¾	36½	21¾	13¼	8¼
	Ideal . .	132	13	11¼	10	34	26¾	37¾	22½	13¾	8½
	Plump	140	13¼	11¾	10¼	35¼	27¾	39	23¼	14¼	8¾
	Overweight	149	13¾	12¼	10¾	36½	28¾	40¼	24	14¾	9
67	Slender . . .	128	12½	11	9¾	33½	26	37	22	13½	8½
	Ideal	136	13	11½	10¼	34½	27	38¼	22¾	14	8¾
	Plump . . .	145	13¼	12	10½	35½	28½	39½	23½	14½	9
	Overweight	154	13¾	12½	11	36¾	29	40¾	24¼	15	9¼
68	Slender . . .	131	12½	11	9¾	33¾	26¼	37¼	22¼	13½	8½
	Ideal	140	13	11½	10¼	34¾	27¼	38½	23	14	8¾
	Plump	149	13½	12	10½	36	28¼	39¾	23¾	14½	9
	Overweight	158	14	12½	11	37	29¼	41	24½	15	9¼

and beauty may be found—a permissible range for individual variation, though of course the central position represents the ideal. When we pass beyond these figures we get into the real ranges of serious "Overweight." The figures given merely carry out the series, being the measurement of those ranging according to height from thirteen to eighteen pounds overweight.

In each case the girths represent the best measurements for those heights and weights. The weights themselves may not be ideal, as stated, but presuming one has that weight, then the given measurements are those at which one's body will look best.

If the weight above our ideal is, for instance, not due to excess fat but to superior muscular development, then our table for women becomes similar to that given for men, and the measurements are in proportion. Such well-proportioned measurements are much more easily achieved at any weight when the weight is muscle and not fat. Ways of accomplishing such development are fully discussed in the present volume.

Indeed it is only the rare individual who can carry excess weight in the form of fat and still have a symmetrically proportioned body; yet occasionally it is attained for a time in youth. Whatever the degree of weight may be, and whether the weight comes from muscle or fat, it is interesting to know how the body holds its proportions from year to year.

To maintain a symmetry of bodily proportions, no matter what the weight may be, the body girths must be in proportion to each other; if they are not, the true human form is lost. Symmetry in this respect is much more essential to beauty than even the relation of girths to height or of height to weight, the eye being extremely sensitive to even slight disproportions.

By the laws of nature, well-developed muscular bodies must retain correct relative proportion between their waists and hips, their hips and thighs, and their thighs and calves. Muscular development in women rarely gets as far out of proportion as it may in men. Bad proportions in women are always chiefly due to uneven distribution of fat.

The relation between different measurements may be expressed in percentage, and this is one of the best ways to check up on individual proportions. The ideal ratios are about as follows, the figure representing the smaller measurement expressed as a percentage of the larger These are shown herewith:

Bust girth to hip girth	91
Waist girth to hip girth	71
Waist girth to bust girth	78
Thigh girth to hip girth	60
Calf girth to thigh girth	61

Special Developmental Exercises for Women.—On the following pages are presented some special exercises for women for various individual parts of the body In all cases a series of general exercises is to be advised for purposes of general development and constitutional benefit, in addition to any of the movements illustrated here, but in many a course of general exercise is not sufficient to get the best results. There are few who are not more or less one sided in their development, or particularly lacking in some special part, and in order to overcome such defects and bring them up to the normal symmetry of the rest of the body, some specific exercises are necessary

Additional exercises to promote symmetry of the female form appear in Part 4 of Vol. I, under *Controlling Body Weight.*

Abdomen—(See *Stomach and Pelvic Region*)

FOR THE SHOULDERS

Standing erect and with arms outstretched, the upper body is turned so that the shoulders are swung as far back as possible. Each shoulder is used alternately in this manner. The use of dumb-bells is not necessary to this exercise which may be performed as a free hand movement. If desirable other objects may be substituted for the dumb-bell.

FOR THE BACK

With the feet wide apart as illustrated, the arms are swung upward and the body backward to the position shown. Next the arms are brought forward and down to the position shown in the following illustration.

Arms.—Beautiful arms will go far to distinguish and to add to the personal charms of any woman. The arms are used so extensively in most of the activities of life that one may easily find a multitude of serviceable exercises for them in addition to those presented here, which are very simple though effective. It really does not matter so much just what exercises one takes, so long as they vigorously bring into play the muscles for both flexing and extending the arms.

As for the forearms and hands, it may be said that exercises for these parts should consist chiefly of taking hold of things and developing what is called the "grip," for which reason all apparatus exercises are valuable if one has the facilities convenient. The mere act of taking hold of a bar above the head, and suspending the weight from it, will provide for the use of the grip, which really means the muscles of the forearm. The flexing of the hand in all directions at the wrist will also improve the forearm, involving all of the muscles of these parts not used in flexing and extending the fingers. Simple flexing movements of the wrist with dumbbells in the hands will answer all the requirements of these muscles in most cases.

Back.—In discussing the subject of proper carriage, we have al-

ready alluded to the importance of strength in the muscles of the back, for it is chiefly upon these that one depends for the upright attitude of the upper body. With a weak back one can accomplish almost nothing. Indeed, one need only refer to the number of women suffering from weakness in this region to emphasize the importance of special attention to its development.

In Part 2 of the present volume, many of the back exercises for men will afford suggestions for women. It is true that some of the exercises suggested there will be found of a nature entirely too vigorous for the average woman, or otherwise unsuited, but others of the movements illustrated will be of great value, and it is well also to understand the reasons why these exercises are of such value in building vital or nervous energy.

From the position shown in the preceding illustration, the arms are swung forward and downward between the legs to the position here illustrated. The backward movement is alternated with the forward movement until the muscles involved are reasonably tired.

Breathing.—The subject of proper breathing is so important that although it has been taken up elsewhere, it has been thought best to make brief reference to it here lest it should be overlooked. There

is perhaps no phase of physical training which is of more vital consequence than this matter of breathing, for it is upon this uninterrupted respiration that we depend to keep up the very fire of life Any stoppage of the breath is very quickly fatal, and since the very fact of continued breathing is so important, the quantity and character of it is also a pertinent consideration

Natural and deep breathing should especially be given attention by women.

The reader should study the discussion of proper breathing in Parts 1 and 2 and will be repaid for attention to the illustrations presented there. It should be noted that in the expansion of the lower part of the torso through diaphragmatic inspiration, one can feel the sides of the body expand outward, and the lower back backward at the same time that the region of the stomach moves outward in front. This complete expansion of the body all around is the essential and also the test of proper breathing

Bust and Chest.—The development of a perfect and beautiful bust is one of the first requirements of vigorous and magnetic womanhood, not only because it is an essential to the symmetry and exquisite con-

FOR THE CHEST

With shoulders well back and arms in the position illustrated, various exercises for the chest may begin. Some of these are here suggested: (1) Keeping arms outstretched, describe small circles from six to ten inches in diameter with both hands at the same time. (2) Bring hands together overhead. (3) Bring hands together in front of body, immediately in front of shoulders. (4) Cross forearms before body as illustrated on facing page.

tour of the body as a whole, but because of its vital significance as an expression of superb womanhood itself. A faultless bust is to be desired not only because of its esthetic and artistic value, but for the far deeper and biological reason that it is so intimately related to the very fountain of life.

The lack of bust development is an evidence of lack of vitality and health. It is true that one may have the health, so-called, which permits her to be on her feet and to walk around, but she is not a complete woman or in perfect health if she is lacking in this respect. A flat-busted, flat-chested condition may not indicate absolute sterility in a woman, but it indicates a condition of health in which approaching sterility may be a possibility, or in which, if not sterile, she may be productive of offspring lacking the full degree of vitality which should be the birthright of every child. It is significant that large families are the rule among those nations or in those localities characterized by full-busted women—women able to nurse their babies instead of bringing them up on patented milk combinations administered in bottles. The full and perfect bust makes a woman attractive because it indicates her fitness for motherhood, which also to a very large extent explains her magnetic quality.

From the position shown in illustration on preceding page, bring the arms down and in front of body so that the forearms cross each other. Return to original position and repeat movement. Exercises involving the crossing of arms in front of the body in this manner are useful in chest and bust development. It is not necessary to use dumb-bells and the movements may be performed as free hand exercises, with the hands closed, or other articles of suitable weight may be substituted for dumb-bells.

The first essential of perfect bust development, therefore, is the attainment of the highest

possible degree of health and vitality. A condition of vigorous womanhood will assert itself in this way, for upon this fact, together with the requirements of perfect nutrition, depends the development of the glands of the breast which give it fulness. Next to this, a certain degree of muscular vigor is essential to prevent that sagging or falling of the parts which is inevitable in a state of weakness. On this account special exercises are indispensable.

We are presenting here some simple exercises which affect the muscles of the upper chest, not only because a full and well developed chest is necessary to serve as a sub-structure for the bust, but because it is the use of these muscles which will directly influence and invigorate the bust itself. It should be remembered that these muscles are concerned with the movements of the arms and shoulders, and that any other exercises which have to do with pulling the arms and shoulders forward, or pulling the arms downward and forward from overhead, will also be effective.

There is one important phase of the subject, however, which deserves special attention, and that is the misunderstanding of the popular mind as to just what constitutes a perfect bust development. It is thought in many quarters that the ideal development of the bust is a very large one, but there never was a greater mistake. An excess of size in this part often means that a deposit of flaccid adipose tissue has taken the place of atrophied glands and muscles, so that conditions may be even worse than in the case of the flat-busted woman. Here, as elsewhere, mere fatness is neither desirable nor beautiful. The quality for which the average woman should strive in the bust should be firmness rather than large size, in order that the parts will stand up in the lines of their true beauty, instead of sagging as the large and shapeless breast is sure to do. It is only in the case of motherhood or expected motherhood that the bust should normally exceed the modest size or development of a healthy, vigorous maiden.

Works of art everywhere corroborate what is here said upon this point, for in both the classic figures of the antique and in all of the best works of art of the present day, the reader will see that the universal ideal of artists is a bust which is not large, but firm and well rounded.

Therefore do not be alarmed if you have not a large development of the bust. See rather how vigorous it is, how firm, round and full in contour, and how closely it approximates that ideal which is expressed in these various works of art.

Hips.—A normal development of the hips is a most important factor in bringing about the suggestion of perfect femininity, for it is in the lines of the hips that the two sexes differ most widely. The woman lacking in this respect does not have the aspect of womanliness, as we have come to associate it with the most perfectly developed representatives of the sex. By this is not meant a large development but rather the normal and natural outlines which go with perfect physical condition.

Aside from the special exercises given here, the reader should note that such activities as walking and running, the latter especially, and all pastimes which have to do with walking, running and jumping, call for vigorous use of the muscles of the hips. And all such exercises will be equally valuable for reducing the hips when too large and burdened with fatty tissue as for building them up when too narrow and small. The influence of exercise in all cases is to restore a normal condition of the parts concerned, and thereby to bring about the condition of greatest possible symmetry and beauty. All open-air sports, therefore, can be recommended in connection with special exercises for improving this part of the body. The general lines of the figure depend upon the hips to such an extent that they should not be neglected.

Legs.—Not a great deal needs to be said here about the lower limbs, inasmuch as they will be vigorously employed by many forms of outdoor exercise if the intelligent seeker for health and strength devotes herself as fully as she should to all available open-air games and sports. A couple of exercises are illustrated here which will be of value, and which may be practiced night and morning if there seems to be any special lack of development of these parts.

Neck.—A perfectly developed and beautiful neck is one of the very first charms for which the physical culture woman should strive, for even more than the arms, it is a part of the body that everyone sees and cannot help seeing. Sometimes the fashions for women seek to cover up the neck, but even in such cases its form and character are more or less evident through the lace or other covering. A thin and scrawny neck is not only ugly in itself, but it expresses a lack of vitality and of general development, just as a full, round throat and a well-set aspect of the back of the neck indicate life and vigor. After realizing the importance of strength of the spinal column, the reader will understand why a well-set neck is associated with energy and power. Others may not understand the reasons for this, but instinc-

tively they get the same impression of an individual, and, whether this is unconscious or not, the woman with an undeveloped or emaciated neck will have great difficulty in giving others the suggestion of personality.

The exercises illustrated here are very simple, but they are none the less effective on this account. They are not of a nature to build a prodigious degree of strength in this part, but rather to develop the neck normally and thoroughly, giving it that combination of grace and strength which makes for the greatest beauty. There are comparatively few girls and women who have really perfect or beautiful necks. They may envy the graceful throat of some other woman, deploring the condition of their own, yet the neck is one part of the body that responds most quickly to exercise. It is often surprising to note the improvement that may be accomplished by these simple movements diligently persisted in for a period of a few weeks.

Shoulders.—In a general way the beauty of the shoulders is associated with that of the neck, just as their lack of beauty is associated with an undeveloped condition of the latter. It is true that the shoulders are ordinarily covered up, and yet their beauty is often more or less manifested through laces and other forms of summer dress. Many young women desiring to wear evening dress have been humiliated by the fact that they would be absolutely unpresentable in any costume which disclosed the shoulders.

FOR THE NECK

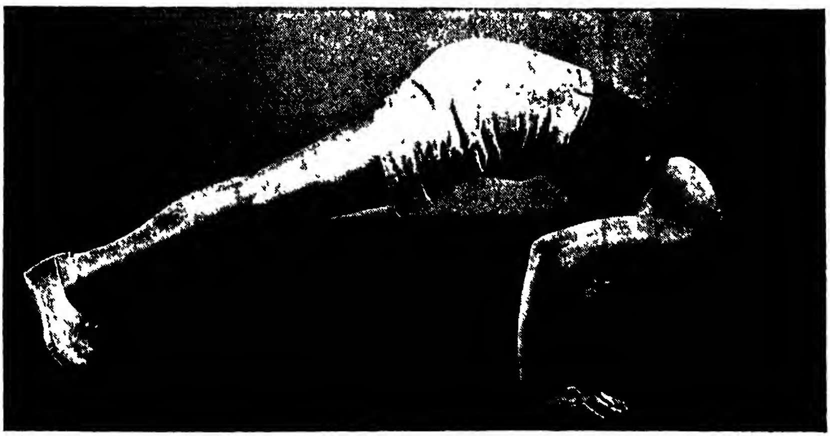
In this exercise resistance to the backward movement of the head is provided by the hands which are interlaced and at a point above the neck. The head is brought back against this resistance and then bent forward and the entire movement repeated until the muscles involved are tired but not to the point of discomfort.

To a very large

extent, the possession of beautiful shoulders is a matter of development and their proper carriage. A lack of strength in the muscles back of the shoulders gives rise to the tendency toward round shoulders, and exercises will not only establish them in their proper position but will develop and fill out their contour. To a great extent also, the beauty of these parts depends upon satisfactory nutrition, and if the unsightly hollows which sometimes mar the front of the shoulders are to be overcome, it is necessary that one pay close attention to a proper diet, insuring a good digestion and faultless assimilation, and building up the very highest degree of general health. Under conditions of satisfactory nourishment, the practice of these special exercises cannot fail to produce a perfect and exquisite beauty of the shoulders.

Together with these, there are many other arm movements and some exercises for the chest which will be very helpful in improving the shoulders. Exercises which bring the arms backward, and to some extent those which bring the arms upward, will be effective.

Stomach and Pelvis.—There is probably no other form of weakness so common among women as that of the muscles and tissues in the region of the stomach and abdomen. For this reason too much could hardly be said to urge the importance of adopting special exercises for



FOR THE NECK

This movement, although strenuous, may be performed after some degree of practise by women as well as men. A cushion is useful for the head in performing this exercise. Taking position illustrated, with the weight of body supported by the head and feet, and with the arms employed to keep the body balanced, the shoulders are moved forward and backward to exercise the neck muscles. The exercise may be performed as long as possible without injurious fatigue.

strengthening and developing these muscles, and in that way invigorating the internal organs and making firm all of the other tissues adjacent. A very large proportion of women suffer from all kinds of disorders of the delicate pelvic organs, disorders which are for the most part the direct result of weakness and laxity of these tissues, poor carriage and imperfect circulation, the latter largely growing out of the other two causes. There is substantially one way for correcting the condition of stretched ligaments, prolapsus and general laxity of all parts, and that is through exercise. This is a matter that is taken up in Volume II, Part 1, in connection with its curative aspect, but it may be said just here that practically all difficulties of this kind may be avoided in the first place by any form of exercise which will develop the muscles of the stomach and abdomen and strengthen the entire pelvic region generally. Here, as elsewhere, the preventive method is infinitely more wise and important than the curative, although substantially the same general scheme of exercise and vigor building will apply both in prevention and cure.

Perhaps the very best exercises for the muscles of these parts are the simplest, and it is such that we are illustrating here. The student of physical culture will know a great variety of other exercises which will accomplish the same results, and many of them are illustrated in connection with the class drills and other series of exercises in this work.

It seems to be the common notion that a woman's body is naturally soft in these parts, in spite of the fact that the walls of the stomach and abdomen are very rugged and strong in the case of the male sex, when in good physical condition. In other words it seems to be taken for granted that the stomach and abdomen of a woman should be flaccid, shapeless and altogether without character, a hopeless and impossible suspension of loose flesh when not retained and supported by a corset. To say nothing of the actual possession and toleration of such a condition, even such an idea of the temple inhabited by earth's intended fairest creature, is something to be ashamed of. But it is not true that any such is a natural condition, for when normally and naturally developed, a woman's body should be just as firm and snug and symmetrical in these as in any other parts. There should be the same substantial external wall of muscles covering the abdomen and the region of the stomach that we see in the male athlete, though naturally in the case of womankind there are not the same rugged and conspicuous outlines. Everything is smooth. If only for the sake

of avoiding the danger of serious ruptures, every woman should make it a point to strengthen these parts, but exercises for this purpose will also help her to consume and obliterate the layers of fatty tissue which so often accumulate over the abdomen. Although, as pointed out heretofore, a prolapsed condition of the internal organs may usually be traced back to weakness of the back and the consequent faulty carriage, or at least largely so, yet weakness of these muscles is a contributing cause in most instances, and their vigorous development will help greatly in improving the carriage and avoiding prolapsus in the future.

Waist.—We are illustrating herewith some special exercises for beautifying the waist. A firm, snug and symmetrical contour of the body in the region of the waist is an absolute essential to the physical culture woman who wishes to present a good appearance, and although general exercise will usually bring this about in due time, it is often well to pay special attention to this part of the body.

The average woman disregards the simple rules of health that would help her to maintain her figure of youth, and too many find themselves burdened with masses of shapeless fat, especially about the abdomen and waist. But with the practice of special exercises, faithfully persisted in mornings and evenings, she can accomplish almost a transformation of her figure. It may be said here that it is better to take exercises for special purposes twice a day, while systematic exercises for general development and constitutional benefit should usually be taken but once daily.

It will be encouraging to those who are in the worst condition to know that it is precisely they who will be able to make the most startling changes and improvements in the shortest time. When very poorly developed, the body will respond quickly to exercise, and will rapidly progress to a point not far from the normal. After securing a pretty fair development, however, it will take a great deal of persistent exercise to carry the development only a little farther. Wherefore, let the hopeless ones take hope, for they should soon be in a condition to surprise all their friends, as well as themselves.

Rope Skipping.—Rope skipping is an exercise particularly to be recommended for its fitness to the needs of women. It is in truth just as well adapted to the needs of men, and is used extensively by boxers in training for extended contests, but it has that element of grace and lissome activity which appeals most powerfully to the feminine temperament. There is no pastime more dear to the heart of the school-

girl, in whose physical development it frequently plays a quite important part. However, since childhood is suited to games of activity and agility, but without the stamina for prolonged endurance, the young schoolgirl should be advised against trying to make records as to the number of jumps or skips she can go with the rope. She should be encouraged in this excellent exercise, but with the suggestion that she strive for variety of fancy steps, none of them very long continued. In adult womanhood, however, there need not be any fear of overdoing by too prolonged exercise, provided the rope skipping is not continued for more than ten or fifteen minutes. More time, with brief intervals of rest, would be better, but young women, when in fairly good training, have possibilities of endurance like those of young men.

Rowing.—As splendid an exercise for women as for men, this wholesome outdoor sport is described in Part 6.

Running.—Running is a vigorous and most beneficial form of exercise for women, not so much as a competitive sport, but as a means of physical development and health building. There is nothing in the world that will do so much for beautifying the hips, though the legs will also be perfected to the highest degree through daily sprints. There was a time when it was thought "unladylike" for a young woman to run, but the world is modifying its opinion upon this subject, in the direction of common sense, and games for women in which running forms the greatest activity are now very numerous.

In Part 2 of this volume, the subject of running is discussed in detail, under the head of track athletics, and while our fair readers may not be interested in the competitive aspect, nevertheless they may glean some points of form which will be very useful. It is comparatively easy to overdo this vigorous exercise, and one should *never continue running after it has ceased to be a positive pleasure.*

Sports and Games for Women.—All manner of open-air sports and games are especially to be recommended for women, in order that they may develop the same splendid stamina and endurance that their athletic and sports-loving brothers enjoy. Tennis, golf, rowing, riding, swimming and other vigorous outdoor pastimes will not only develop strength and promote the most vigorous health, but will do more for accentuating the natural beauty of girlhood than all other influences combined, with the exception of a wholesome diet and systematic exercises for special purposes. It needs hardly be repeated that outdoor exercises are infinitely more valuable than those performed indoors.

Walking.—Though the subject of walking has been taken up in another place, it is mentioned here because of its value and importance to women as a means of acquiring health and beauty. It is a form of what we may call constitutional exercise, valuable for its health-building qualities rather than as a means of any special bodily development. It improves the circulation and the digestion, tones up all of the vital and functional organs, favors perfect action of the depurating organs and brings about that purity of blood that gives a good complexion. No matter what special and systematic exercises one may take for building muscular strength and symmetry, everyone should do at least a certain amount of walking in the open air, breathing the pure air freely. The reader is referred to the general discussion of this topic in Part 5 of the present volume.

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PART 12

BEAUTY AND PERSONALITY BUILDING

BEAUTY and personality, in their most obvious and immediate manifestations, are physical. Lack of personality, absence of the power to receive and to convey genuine satisfaction in living, these often accompany mediocre health.

Even the unprepossessing individual in a great measure can make up for a poor first impression by cultivating qualities that wear. It is not unnatural for individuals who thus improve themselves to be critical of the more superficial elements of personality. Yet there is nothing wrong with beauty and physical appeal except that some people who possess them are satisfied to depend on them to the neglect of more solid traits of character.

Beauty, even when the beauty of the skin only is being considered, is as deep as the innermost working of the human body, for health is the basis of beauty, and the health-seeker is a beauty-seeker even if she or he vehemently denies the charge.

Facial Beauty.—All sorts of devices and medicines and complicated and costly methods are followed by the beauty-seeker as though beauty were bestowed in about the same fashion that a poster is slapped on a billboard. Gazing at the stars, she sees not what lies to her hand. For beauty, poetical though its conception may be, has its root in prosaic ground. The same factors which build up flesh and blood, bones, muscles and nerves of the body are the architects of beauty. Beauty is of the body and not apart from it, and its builders are those processes which maintain bodily health: breathing, eating, drinking, exercise, bathing and sleep. Its acquisition does not depend on chance, but its development lies within the control of each one of us.

A clear complexion, eyes that twinkle at the slightest excuse, a supple, strong body, the ability to run and jump with the agility of an antelope—these are the attractive outward expressions of inner health.

In early Greek history, when there was free intermingling of lightly clad boys and girls in sports and dances, and to a certain extent in

athletic exercises, the love relations of the sexes were ideal. Seduction and adultery were so rare that instances became notable historic events. It was only in later times, when the Greeks denied to their girls the intellectual education accorded their boys, and the young men sought for companions either among themselves exclusively or among brilliant foreign women, that licentiousness began to prevail. Then it was, too, that the Greek maidens began to lose the beauty for which they had been famous, and degenerated into household drudges, and querulous mothers and wives, of which Xantippe, the scolding, unattractive "helpmeet" of Socrates, was the type.

Now, man is the creature of natural conditions. What he has been in the past, he can be, if not in the present, in the very near future. It is entirely possible, if we but obey the laws of Nature, within a generation or so to restore the race to the pristine beauty of early Greece. Through the great development of physical culture among our young men and women, and the increase of wholesome companionship between the sexes, there is promise that there will shortly be produced a type of humanity that shall equal in physique any the earth has yet brought forth, and in mind and soul shall set a new standard for the race. It is ~~particularly~~ the duty ~~of the~~ girl, as at present the less free of the sexes, to fit herself properly to function as the mother of this regenerated people. And in so fitting herself she will receive an advance payment of that beauty and joy which are the rewards of ideal motherhood, in the form of girlish charm and happiness, the sure indexes that she is fulfilling rightly her part in the plan of Nature.

If, through her health, a girl can control her general attractiveness, she need not be concerned about minor details, such as the color of her hair or eyes, the size and shape of her nose, the tilt of her chin, or any other inherited characteristics. A fine personality, which is the natural accompaniment of a healthy, thoroughly developed body, can reform any feature or collection of features, endowing it with charm. Remember that the beauty of the whole transcends that of any part.

Therefore it is that men are often at a loss to explain why they consider a certain girl beautiful. Analysis of her features does not help them out. What has really attracted them is simply good health. Rosy cheeks, rounded limbs, an alert manner and a happy disposition —all the result of natural living—give that personal charm which all women desire, and to acquire which many are willing to submit to tortures even.

Yet only a little self-denial (which quickly becomes a pleasure) is required of a girl who would make herself attractive. When the terms "beauty" and "health" become synonymous in her mind, to attain her object she will be willing to sacrifice some pleasures of the lower senses —such as comes from the eating of chocolate creams, the absorbing of unlimited ice-cream sodas, lobster and oyster suppers, and rich animal food in general. She will then no more dream of swallowing harmful things than of wearing an unbecoming dress, or a hat which does not harmonize with her hair or complexion.

Nor will she be content with negative requirements alone. She will inaugurate a system of exercise of at least ten to twenty minutes daily, followed by a cold bath, in addition to her walks and outdoor pastimes, for this is the best of all practices for keeping the blood pure and the internal organs clean and in perfect working order. Every famous beauty and every actress celebrated for her personal charm know this secret, and they faithfully persist in these morning exercises and cold baths for the sake of the resultant youthfulness and beauty that these impart to face and form.

Bathing.—'Tis a trite phrase that cleanliness is the handmaiden of beauty, and the first office of the bath is to clean. The skin is one of the organs by means of which the body is relieved of waste. Its depurating action is unremitting and thus there is constantly exuded on the surface waste matters. Hence, unless frequently bathed, the skin suffers in appearance, firstly, by reason of its uncleanliness; secondly, becoming clogged up, the wastes are not readily eliminated from the blood, which becomes impure. In consequence, the whole system suffers, the skin taking on a yellowish tinge, and the complexion becoming dull and sallow and coarsened by enlarged pores.

But, perhaps, one of the most valuable of baths for the skin, one that never fails to improve its texture and color, is a bath that does not require water—the friction bath. It stimulates the circulation to the skin and thoroughly cleanses it. The friction bath is self-applied by the use of soft-bristled brushes. Beginning at the forehead, the face and neck are thoroughly brushed, then each arm in turn (working upward from the hand to the shoulder), then using both brushes together, the shoulders, chest, sides, abdomen, back and lastly the legs, brushing from the ankles upward. The treatment is continued till each part of the skin is in a glow. It will be hard to reach the back of the body, but do the best you can. When taking the friction bath for the first time, it will be necessary to avoid vigorous brushing and

not to continue the treatment very long, as in the beginning the skin is easily irritated, but as the treatment is continued from day to day, the skin becomes accustomed to it, and it may be made as vigorous as desired. The friction bath will put one's skin in splendid condition, and it will not be possible for pimples, blackheads, or other eruptions to develop when the friction bath is a regular practice. The ordinary Turkish towel may be used for the friction rub instead of the brushes.

For a complete discussion on baths for cleanliness and for building health and beauty the reader is referred to Volume IV, Part 1.

Face, Washing the.—Absurd as it may seem, it is nevertheless necessary to instruct the average person when and how to wash the face. From at least those days when Shakespeare's schoolboy, "with shining morning face" crept like a snail unwillingly to school, it has been the custom to wash the face regularly on arising from bed, and rarely before retiring. The practice should be just the reverse. The evening is the proper time for thoroughly cleansing the face, since it has all day long been accumulating dirt of all sorts, the grime of toil, the dust and dessicated manure of the street, the germs floating in vitiated air, and some of the waste matter of the body which has exuded through the pores, and been retained on the surface and in the creases of the skin. To remove all this one should carefully cleanse the face every night before retiring.

Breathing.—A scant chest measurement, with little increase during the expansion of breathing, indicates lung weakness or a susceptibility to such weakness. The lungs are suspended within the bony cage made by the ribs and spinal column, and are very much like a pair of bellows: when the chest expands by muscular effort, whether conscious or unconscious on the part of the individual, the lungs fill with air, which merely rushes in to fill the vacuum. The more the chest expands the more air will enter the lungs, there to provide the life-giving oxygen to the blood. It is absolutely impossible to oxygenate the blood fully and to send it bounding through the arteries to supply vitality to every organ and member of the body when one breathes shallowly. Without deep breathing one is anemic, spiritless, lacking magnetism, and that "color of personality" which is the central quality of personal charm and beauty.

Carriage.—But the best method for preserving the beneficial effect of this physical culture and for securing permanent mental and physical relief by means of correct breathing and the other natural functioning

of the body organism, is to form the habit of holding in the mind, throughout the day, the ideals that have been set forth, and acting upon them as occasion permits. Thus when you stand or sit, let it be in balance—naturally straight at front and back and without an inclining position either to one side or the other. If you bend let it be at the hips. Avoid a slouching position; keep the shoulders back and the head well up.

The eyes of men brighten with appreciation when they see a woman instinctively well poised and with a good carriage. They themselves feel they are in the presence of a superior woman and so conduct themselves accordingly. Their mental attitude changes to greater affability, their wits sharpen, their minds and hearts take on a spirit of grace and chivalry and they feel that they want to be better men, more gentle, more kindly, more courteous—to be real gentlemen in every sense of the word.

For projecting ears, the use of a bandage holding them closely to the head during sleep may be employed. Measures of this sort are more effective in childhood before the cartilage and bony structures of the body have become firmly fixed and hardened.

Your own self-respect and approbation are an even greater reward for diligence in exercise. A perfect bodily development brings with it a realization of the best delights of life. With every part of you tingling with vitality, you taste sweets unknown to you before you gave your body a chance to develop as Nature intended it to. Those emotions which are characteristic of girl-

hood and young womanhood reach perfection only in complete health. They are yours for the seeking.

Ears, Projecting.—If these are taken early in life, they may be benefited to a large extent. Every night the ears should be bound close to the head, by means of a bandage, passing entirely around the latter. The ears should not be pressed outward by the hat or cap. If a cap is used in winter-time, the ears should be enclosed underneath it. This is the only local treatment which is of any avail; constitutional methods of treatment may be adopted; but the constant compression of the ears to the sides of the head is the only plan which can be followed with any hope of benefiting this condition.

Exercise.—A fear prevails among women that exercise will give them the hard, sinewy development seen in athletic men. Such a result is impossible in women for the physiological reason that the blood of a woman contains more fatty globules than that of a man, and therefore more fatty tissue is deposited under her skin than under his by an increased circulation, such as comes from exercise, though excess of fat is carried away. Thus a man may grow lean, and a woman plump as a result of identical physical training. No matter how muscular a woman may become by exercise, this fatty tissue always fills in the hollows of the frame. The muscles themselves become more symmetrical by proper training, and, while they grow firm, do not become hard. Furthermore, the increased circulation makes the skin soft in texture and clear in appearance, its perfect health enabling it to eliminate through the pores all waste matter. A bad skin is always indicative of imperfect elimination of this sort. Very often a woman's face will be sallow in color, and marred by pimples and blotches, while the skin of the rest of the body is white and clear. This is due to the fact that heavy and restrictive clothing interferes with elimination of waste elsewhere than in the face, the skin of which has therefore to do all the work, and, this strain combining with impaired circulation, it does it incompletely, and is poisoned by the waste matter which it retains.

Eyes, Care of.—Just as the shaft is only the apparent hair, while the root is the real hair, so the real eye is to be found in the optic nervous system, not in the eyeball, which is merely the terminus of the system, the end of a nerve, a marvelous mechanism, it is true, but subordinate to the vital organism behind it. The mechanical rather than organic character of the eyeball is demonstrated by the fact that, if impaired, or if parts of it, even, are destroyed, the loss can be repaired

by the aid or substitution of artificial contrivances of glass, while, if the optic nerve is impaired, the only remedy possible is the restoration of its powers, and if it is destroyed, no substitute for it can be found. Consequently proper treatment of the eye should include the whole optic system, instead of the eyeball alone, as is commonly the case, and as treatment for nervous disorders largely depends on that which influences the whole body, the hygiene of the eye is therefore principally constitutional.

The eyes are capable of expressing not only general emotions and broad traits of character, but also ideas and specific thoughts. Not only figuratively, but literally some people "talk with their eyes."

Wherein this wonderful power of expression consists, writers have never been able to determine. Like beauty in its various manifestations, by its very elusive mystery it charms as it bewilders us. Many theories of the beautiful have been advanced by philosophers at various times, but in no instance have they been able adequately to explain *how* or *why* certain combinations of colors and of form should excite pleasant rather than unpleasant sensations. And this is specially true of the eyes. The most delicate instruments might not be able to establish a perceptible difference in color, form or size of two pairs of eyes, and still one pair might be considered beautiful and the other homely.

But these are matters of psychology, physiognomy, and theoretical esthetics into which we have no business to enter here. Study of these subjects will lead to no practical conclusions as to the cultivation of beauty and expressiveness in the eyes, save it be the general negative one that these qualities can be obtained only by cultivation of the mind and character which they express.

Let us, therefore, revert to the simpler, surer, and more practical ground of hygiene, wherein will be found many suggestions of substantial value as to the cultivation of beautiful eyes.

First of all, the eye to be beautiful must be strong, that is, free from all defects, such as myopia, obliquity, and astigmatism. Second, the eye must be clear, that is, free from the discolorations of impure blood. A perfect digestion, a healthy and energetic circulation of the blood, a delicate nervous poise, are all physical prerequisites to beautiful eyes. Form, color and size, however important in themselves, avail nothing without the luster and brilliancy and expression imparted by general physical tone, and, though the shape and color of the eyes can never be changed, they can be greatly improved in strength and appearance

by a rational system of constitutional and hygienic treatment, which, by toning up the nervous system, improves the real eye, the optic nerve.

Unfortunately modern scientists are apt to be opportunists instead of radical reformers. They prefer to patch up rather than to rebuild. Thus oculists have been more impressed with the wonderful mechanism of the eyeball than with the less striking, but far more important physiology of the optic nerve, and have concentrated their attention on supplying defects by artificial means, rather than curing them by natural means. Spectacles have been rightly called "eye-crutches." From the number of people wearing them the present generation appears a race of eye-cripples. They are found on almost every old person, on every other person of middle age, on many young men and women and on a noticeable number of children. Were as many people to be seen hobbling about on wooden crutches and canes we should exclaim at the terrible condition, look around for the cause, and set at once to remedying it. Yet there is no excuse for more people to wear spectacles than to use crutches. Proper attention to general health and judicious care of the eyes in the early stages of the trouble would have saved nine out of every ten wearers of spectacles their present necessity of leaning on these crutches.

There is no better index of general health than the eyes. They sparkle with vitality when their owner is well; they lose their luster when he is in bad health. If the functions of the various organs are properly performed blood is furnished to the eyes in all its purity. The eyes nourished with pure rich blood are brilliant, healthy and strong. But if the defecating organs are slow and torpid in their functions, a sluggish circulation of impure blood follows, and the eyes, along with the other bodily organs, grow weak and dull. Imperfect digestion and general nervous debility affect the power of the eyes for usefulness as well as their appearance. So true is this, that one may safely assert that nearly every case of defective vision not caused by intemperate use is made possible by the general debility of the whole system rather than the local causes usually blamed. The futility of applying local remedies thus becomes manifest. They fail to remove the cause of the trouble. To the true oculist the eyes should be, as in fact they are, the thermometer of health; and the first step in the diagnosis of every case submitted for treatment should be a careful investigation of the patient's general physical condition. If, upon examination, it be found that he is suffering from pronounced general debility, the very first efforts should be directed toward the correction

of that and toward the establishment of a healthy nervous tone through a simple, nutritious and abstemious diet, fresh air and exercise, together with the local and other treatment advised.

Weak Eyes and Defective Eyesight.—Leaving out physical weakness, one of the chief causes of weak eyes is overwork. To persist in fine needlework when the eyes have registered a protest; to read fine print, or coarse print on inferior paper; to strain the eyes by attempting to read in a dim light, is but to court disaster for the visual powers. Strained eyes, like sprained ankles cannot be cured in a day, nor by the application of local remedial agents alone. Time, rest, general nervous relaxation, assisted by physical culture, dietetic and general constitutional treatment can alone effect a cure.

Rest and relaxation of the eye is essential to their healthful condition under the stress of modern life. The complete shielding of the eyes from all light, by palming them with the hands as here shown, is a means of obtaining rest for the eyes when overworked.

Instead of taking this rest and constitutional treatment a woman with overworked eyes generally will resort to an oculist, who almost invariably prescribes glasses, saying nothing about the natural remedies. The spectacles afford her instant and grateful relief from the strain and she goes back to her work; thus that which was intended as a blessing becomes a curse, and she goes through life a victim of the spectacle habit, exchanging from

time to time her old glasses for new ones with higher power, as her eyes fail more and more under the unnatural strain put upon them. There is no organ of the body to which rest is so essential as the eye, and the sign of the need of this is weariness, and even the "blessed angel of Pain." These danger signals are taken down by spectacles, which thereby become an obstacle to the attainment of permanently sound vision.

Even where it is perfectly proper to use spectacles for reading, these should be removed at other times, since this will cause an acceleration of blood to the optical nervous system, due to Nature's attempt to cure a declared bodily defect, whereas the continual wearing of the spectacles, by disguising the need, would diminish the flow.

There are unquestionably certain defects of vision that can be remedied by capable and efficient oculists. It need hardly be said that only the most capable and absolutely dependable practitioners should be retained in this connection, for one's eyesight is precious beyond all monetary value. There is an unfortunate tendency on the part of modern men and women to take up the use of spectacles without first attempting to improve the eyesight through rest and by constitutional measures. Remember that the eyes will very often respond readily to local and constitutional treatment, and do not depend too greatly on spectacles, and utterly neglect health-building measures for the relief of their troubles.

If the eyes have been abused for years and years, one can hardly expect the trouble to be corrected and the eyes made strong in a few days or even a few months. It is a slow process, but if, as has been repeatedly emphasized, the methods herein suggested be earnestly and carefully followed, restoration to a condition of normal health must be only a matter of time.

Supplementary to the constitutional treatment of rational diet and exercise, specific massage of the eyes will be found beneficial to them. For this purpose exhaust cups have been devised, which, placed over the eyes, by suction draw the vitalizing blood in increased quantity to the adjacent parts. But the use of these cups is sometimes disagreeable, and there is always danger of excessive suction. Accordingly it is wisest to employ eye-exercises and eye-massage with the fingers, which effect the desired increase of circulation with no disagreeable sensations and under better control.

The exercise of the eyes, by rolling the eyeballs in various directions and focusing the vision on distant objects, draws the blood to the eye-muscles employed, and even to the contractile parts of the eyeball,

and so tends to vitalize these, and further, to stimulate them in their functions.

Exercises and massages should be performed once a day, night or morning, each from five to ten times. Very great care should be taken not to overdo them the first few times. It might be well at first to take each exercise only two or three times each day for the first few days.

After massage, the eyeballs should be carefully bathed in moderately cold salt water, either by using an eye-cup, or by immersing the face in a bowl. In the latter method, continue to open and close the eyes as long as the breath can be held.

Bloodshot Eyes.—See *Watery Eyes.*

Dark Rings Under Eyes.—This is generally a sign of depleted vitality or exhaustion. The periodic menstrual function is a frequent contributory cause. Again, this condition may be due to lack of sleep and proper rest; and if this is the case, the curative measures are clearly indicated. Worry and other depressing mental disturbances and emotions will help to create dark rings under the eyes—and, needless to say, such states must be removed before any permanent cure can be expected.

If the dark lines are not due either to sexual excesses or to fatigue or sleeplessness, they can only be helped by general constitutional measures. A general vitality-building regimen, in which an abundance of exercise; fresh air and a milk diet predominate, will be found helpful. See that the skin is active and that constipation is not present.

Drooping Eyelids.—This is more natural with some types of individuals than with others; it is said to accompany a naturally sensuous type of individual; but the factors which cause the one condition may also cause the other. Persons with drooping eyelids should take good care of their kidneys, since this is often a sign of kidney trouble. Benzoin or the use of some mild astringent to contract the skin, may prove useful. Care should be exercised in applying these lotions, however, not to allow any of the mixture to enter the eyes. Alternate hot and cold compresses will be found useful—always ending with the cold. Care of the general bodily health is essential. Avoid rich and greasy dishes of all kinds.

Eyes, Diseases of.—See *Eye, Diseases of,* and *Sight, Disturbances of,* in Vol. V.

Puffiness Under Eyes.—This is generally a symptom of kidney disease—more or less serious. You may not notice it for years; but it is

Exercise of the eye muscles by focusing the eyes at the extreme right.

Movement of the eyes here illustrated reverses that shown in preceding photograph and focuses eyes at extreme left.

Focusing the eyes at a point immediately above the head and then dropping them to focus them at a point directly below.

an indication, none the less. Of course, if it is only temporary, it may mean simply that you are tired and sleepy—for which condition rest and sleep are all that are required. But if chronic, you should pay particular attention to your general health. Avoid meat as you would a poison—for some weeks at least. Avoid proteid foods of all kinds for some days. In fact, a short fast would benefit you greatly; or a fruit diet for three or four weeks would have the same effect. Drink plentifully of water. We should advise rest in bed for two or three days, if possible; this to be followed by a period of fairly active exercise. Turkish baths would prove especially valuable, as would hot and cold spinal applications. Great care must be taken not to overeat. Avoid all alcohol, tea and coffee. It is especially important to remember this.

Red and Upturned Eyelids.—This is a peculiar condition, sometimes found in the case of people who have red hair. It is rarely found in any other cases. But little can be done to alter the condition. Cold packs, hot and cold eye-baths, etc., may be tried, always ending up with the cold pack. Pulling the eyelids and eyelashes with the fingers in a downward direction, may help. If this condition is due to any inflammation, it may certainly be relieved by these measures, coupled with vigorous constitutional treatment.

Thin Eyelids.—If your eyelids are abnormally thin, it is improbable that you will be enabled to thicken them materially. At the same time, massage, hot and cold local applications, frequent eye-baths, pinching and pulling the skin of the eyelid, etc., may bring about good results in a number of cases. A milk diet might be tried for a while, to build up the flesh and tissues generally. "Blinking" the eyes a number of times a day may be found helpful. Be careful, however, that this does not leave you with a nervous habit of twitching the eyes; if you find that the practice has injurious results, discontinue the exercise at once.

Watery Eyes.—Watery eyes generally denote a weakened and devitalized condition of the eyes and general nervous system, and should be treated locally and constitutionally. A general health and vitality-building regimen is essential, and care must be taken not to overstrain the eyes in any direction. *Bloodshot Eyes* arise from like causes, and should be similarly treated. In addition to the general treatment, hot and cold eye-baths, cold compresses, massage of the adjacent parts, etc., may be tried, generally with noted benefit.

Face.—See *Skin.*

Feet, Care of.—Just as the causes of a tree losing the glory of its foliage may be traced to the cramped condition of its roots, so the loss of beauty to a woman's face is often the result of the ill treatment of a remote part of the body. Many a wrinkle about the eyes is due to tortured, unhealthy feet.

The foot is a marvel of delicately adjusted mechanism scarcely less wonderful than the hand, and yet it is frightfully abused. How few adults there are who have not a permanent affliction of the foot in one form or another, from corns to general tenderness and how many of these accept it as a permanent and unavoidable condition! Yet as improper footwear is the one great cause of these troubles, they can all be remedied by the use of proper shoes and stockings, or, in extreme cases, by discarding footwear of all sorts and going barefoot.

Special exercises for the foot consist in stretching and moving the foot in every possible direction. There are many movements useful for strengthening the foot. The following are examples of exercises that may readily be devised for this purpose.

Sit in bed with feet extended; stretch them to limit of power toward foot of bed. After this preparation, bring right foot up to left knee, rest it and with right hand separate the toes slowly, giving the following exercises:

Pull little toe to right, following with pulling of each toe in same direction, opening spaces between and rubbing gently with fingers very slowly. Push toes to left, beginning with great toe, following with others as above, rubbing spaces between and holding toes apart. Push toes upward and then downward as far as possible without discomfort, in turn.

The adage that vanity, the spoiled child of beauty, is its mother's greatest foe, is nowhere better illustrated than in the case of woman's shoes. A mistaken idea of the beautiful leads the average woman to desire the appearance of having small feet, whether or no these are in proportion to her figure. Therefore she demands a shoe that has a pointed tip, which crowds five toes in a space that has comfortable room for only one or two, and of which the heel is preposterously small and high, and pushed forward under the arch of the foot. Of course, manufacturers respond to this demand, and it is sometimes difficult for a woman to find a sensible shoe. Furthermore, the foot is so weakened by the wearing of unnatural shoes that when rational footwear is adopted which does not give support to

muscles that should take care of themselves, these break down, and, through injury to the bones of the foot, a painful condition results that is sometimes permanent. Accordingly the foot should gradually be brought back by exercise to its natural condition.

French-heeled shoes, by shifting forward the center of support for the body, not alone destroy all grace of carriage, but also have a bad effect on the nervous system. The heel was intended by Nature as the body's support when at rest, and there is a general strain extending through the entire system when this intention is perverted. In walking, the weight is naturally borne alternately by the heel and the ball and toes and the disturbance of this relation by the shape of modern woman's footwear produces an unsymmetrical development of the leg muscles. Indeed, a woman who hobbles along on French heels might as well have wooden legs, so unused are the muscles of the calf, the function of which is to lift the heel while the foot is bending at the toes.

The deformities and troubles of the feet are usually of long standing, having their origin in the wearing when young of improper shoes, which molded the soft and pliable bones and ligaments into bad shapes and encouraged the supporting muscles to neglect their duty. Accordingly to remedy these evil conditions is no short and easy task.

Effects of Footwear.—There is probably no part of the body so much abused as the foot. Placed in tight, ill-fitting shoes, it is made to bear the burden of the entire body. That age is first revealed in the feet is a well-known fact. All too soon, dancing, hiking and other pleasures and healthful exercise are abandoned for an easy-chair and carpet slippers. This is particularly true of women, because of their footwear. The first step in curing the foot of the "evils of civilization" is to give it the proper kind of shoes.

Going barefoot is the ideal condition for the foot, and the nearer that footwear approaches this condition, the better it is not only for the foot, but for the calf and upper leg, and, indeed, the whole body. The moccasin of the Indian and the ancient sandal are therefore the best models for shoes. Each affords the protection desired, without impairing in the slightest the muscular development produced by going barefoot. The sandal in particular retains the hygienic advantages enjoyed by the natural man, since it freely admits the air. It is exceedingly fortunate for children that sandals are permitted them by fashion, since it has taken away from them the time-honored American right of going without any shoes at all. Undoubtedly, if young

women had prettier feet, the practice of sandal-wearing would soon extend to them also. It is only the athletic girl, who has come to recognize the beauty of health and utility in the foot, that fears not to show its natural shape. By the wearing of moccasin-like shoes at the games of tennis and basketball she is paving the way for wearing similar shoes on all occasions. Then the feminine foot will at last be restored to its pristine health and beauty.

When ordinary shoes are worn these should conform as closely as possible to the style for men, differing only in lighter weight and finer finish. The sole should be broad enough to support the sole of the foot in every part, the heel low and broad, and the leather flexible enough to permit play of the muscles, and with its natural porosity unimpaired, in order to permit the foot some degree of "breathing."

Patent leather or waterproof shoes are to be avoided as most unhealthy since the leather has been treated with special design to make them nonporous. Wearing such shoes causes the feet to become overheated, stewing in their own foul perspiration. Stockings, like shoes, should be well fitting.

Negatively as well as positively vanity is responsible for the existence of the many ills and deformities which the feminine foot endures. Were the feet exposed to view, as the hands and face are, no woman would tolerate for a moment, the ill-shapen, unhealthy, and even unclean toenails, and the corns and callosities which are so prevalent.

General Care of Healthy Feet.—Since the heavier clothing of the feet, worn even when the rest of the body is in undress, prevents them receiving any benefit of sunlight and free air, they should be bathed frequently, certainly every night or morning. This will be found a most soothing and restful practice. Bathing the feet before retiring is the best means of insuring a good night's sleep, and bathing them at the beginning of the labors of the day produces a glow which acts as a tonic for the entire body.

The whole art of health has been summed up as "keeping the feet warm and the bowels open," and when the first condition has been secured by an increase of circulation it may be said to imply and include the second condition. Accordingly, though warm water may be first used for thoroughly cleansing the feet, they should afterward be plunged into cold water, and then vigorously rubbed with a coarse towel.

Scrubbing with a flesh brush is also helpful in inducing increase of circulation, and removing the dead cuticle that tends to form callosities.

Aching Feet.—If the feet ache from overexercise, they should be soaked in warm water, in which a little salt has been placed; then dipped in cold water for three or four seconds; then rapidly dried. They may be rubbed with linseed oil, and massaged with the fingers for a few minutes before retiring.

Very much the same measures may be applied if the feet ache without excessive exercise. In that case, however, it is a sure sign that you are upon your feet too much of the time, and you should sit, or preferably lie down, a considerable part of each day, until your feet regain their vigor and elasticity. Cold bathing for the feet will be especially valuable in your case, and a system of exercising them by moving them about in all directions. Rubbing the feet vigorously with friction brushes or a rough towel, thereby increasing the circulation of blood to the parts, will harden them. Bathing the feet in cold, salted water can also be recommended. Keep up the general health, and, as the body is toned up, the "ache" will gradually disappear.

Ankles, Making Smaller.—If there is no superfluous tissue about the ankles, and their size is merely the result of the structure of the bones, ligaments and tendons, then it is practically impossible to reduce their measurements. But if, as often happens, the ankles are heavy through a deposit of adipose tissue, then all exercises involving much activity of these parts are recommended, until you have acquired a clean, muscular outline of the entire lower leg without any surplus of fat. Hill-climbing, running, tennis and similar activities, in addition to special home exercises for the ankles and calves, will do the work. Feet and ankles are nearly always perfectly proportioned to the build of the individual, and if the ankles seem large through their bone structure, then the very same training intended to develop the muscles of the lower leg and make it shapely, will give the ankles the symmetry and beauty that are desired.

Bunions particularly mar the beauty and symmetry of the foot. They are caused by pressure on the joints of the great and little toe. If not attended to they cause, besides ugly disfigurement, great pain. The real cure is a shoe that is broad enough to avoid all pressure, and relief is afforded by wrapping the foot in a wet towel, allowing it to remain all night. The beauty of the foot depends upon the development of the muscles. Properly, two sets of muscles are brought into play during walking, those which raise the heel and those which flex the toes. The compression of the shoe renders any movement on the part of the toes almost impossible, so that the work of locomotion is

almost wholly performed by the muscles which act at the ankle joint. Thus, through disuse, the muscles at the toes largely lose their power of movement—movement which originally was of wide range. This fact is well borne out in the case of persons whose hands through one cause or another having become useless have partially succeeded in training the feet to take their place. Furthermore, if it be considered that certain muscles maintain the large arch of the foot the importance of keeping these muscles strong will be evident. The arch of the foot, besides preserving adjacent parts from jar due to impact in walking, have underlying them nerves and blood-vessels and other tissues which are injured when the arch is broken down and the weight of the body presses upon them. The broken down arch affects one's gait, making it shuffling and ungainly. On the other hand, the arch that is high and well marked besides lending grace and shapeliness to the foot gives elasticity and firmness to the step. Exercises that bring the muscles of the foot into use should be indulged in to strengthen these parts.

Regarding bunions, Dr. Trall has this to say:

"This affliction, though generally regarded as a kind of corn, is really an inflammation and swelling of the bursa mucosa (this is a membrane lining the joint and secreting a lubricating fluid) at the inside of the ball of the great toe. It often produces a distortion of the metatarsal joint of the great toe, and is produced by the same causes as corns. The treatment is, warm foot baths when the part is very tender and irritable; at other times, frequent cold baths; and when a horny substance resembling a corn appears externally, the application of caustic. I have known bad corns and bunions cease to be troublesome after the patient had been a few months under hydropathic treatment for other complaints."

Sore insteps, big joints and corns, when no positive means are adopted for their cure or removal, may often be made tolerably comfortable by having the shoe carefully adapted to fit them.

Callosities.—A most effective treatment for feet that are calloused is to soak them every night for about ten minutes in hot, very soapy water; after which they should be dried carefully, and the calloused spots rubbed with a piece of pumice stone. The kind to be used is the stone in its rough condition, not the prepared kind. When pumice stone is used one should always apply a little grease to the rubbed parts. During the day vaseline should be applied to the spots to prevent them from hardening, and if soft insoles are worn, it will be of

great advantage. Lemon juice is said by those who have used it to be effective in affording relief for this annoyance. After the bath the parts affected should be rubbed with a slice of lemon. This will soften the callouses so that friction with a coarse towel will, if they be of recent development, rub them away. If they are very hard, however, it may be necessary to bind slices of lemon on the parts over night. All pressure on the spots should be removed. The most common seat of a callosity is the ball of the foot. The fallen metatarsal arch, which is the cause of this pressure, should be corrected at once. For the causes and proper treatment of this pedal ailment, see *Flatfoot,* in alphabetical order in Vol. II.

"Sweaty" Feet.—If too much food is ingested and the work of expulsion is not distributed among the depuratoring organs as it should be, the system takes advantage of the favorable circumstances of overheating by socks and shoes to discharge as much waste as possible through the feet. Rational treatment calls for reformation in eating, drinking, exercising, clothing, and bathing habits, not in some medicated liquid that will prevent perspiring of the feet by paralyzing their sweat glands.

Not only is constitutional treatment, such as outlined under *Catarrh* (Vol. II) indispensable in these cases, but changing the socks daily, washing the feet with pure soap and warm water followed by cold three or four times per week, bathing the feet in cold water night and morning, wearing thin hosiery and low shoes, preferably of porous kid leather, and going barefooted frequently, are also urgently required. The bowels should be kept active by eating less of the heavier foods and more of the fresh fruits and vegetables, drinking plenty of water, and taking considerable exercise, including a long daily walk. Increase the activity of the skin through air, water and friction.

The *nails* of the toes should be trimmed for comfort rather than appearance. They should always be left longer than the toes which they are intended to protect, and should not be filed down too thin. The cutting will be greatly facilitated by first bathing the foot in warm, soapy water. The toes should be carefully scrubbed with the nail-brush to remove every particle of waste matter.

Nails, Ingrowing.—Owing to the wearing of tight shoes, ingrowing nails are apt to occur, especially in the case of the big toe. Where this inclination is observed, the corners of the nail should not be rounded and a pinch of absorbent cotton should be inserted under its sides by means of the orange-wood stick, to lift the edges.

Hair, Care of.—Like the rest of the body the scalp requires air, a condition prevented by any form of tight headgear. The steady weight and pressure causes the scalp to become unnaturally overheated; keeping the roots of the hair in a continual sweat-bath, causing them to veritably "rot," just as would a plant if continually kept covered with straw or manure.

Curling the Hair.—There is no natural way of making straight hair curly. The wave and curl of the hair is due to the uneven texture throughout its length, in consequence of which it curls or waves. The natural wave or curl in the hair is more evident during damp weather. There are certain fluids advised as a means of curling the hair, but their effect, if any, is temporary and at best they are useless. If the hair is cared for in accordance with the instructions given in this chapter, its appearance will be all that could reasonably be desired. By rubbing and drying the hair thoroughly with a heavy towel after washing it, a certain degree of waviness may be acquired.

Singeing the Hair.—The value of this process has been much debated. Certain it is that the old idea that it closed up the ends of the hairs, which were otherwise inclined to "bleed"—that is, lose some vital energy in some way—is quite given up as a superstition. In the case of hairs whose ends are *split,* it may be useful to singe the ends, to prevent their splitting further; but in all other cases, or in the case of healthy hair, this is not a measure to be advised.

The condition of the hair can frequently be determined by the nails. If the nails are brittle and break easily, it indicates quite clearly that the hair is in a similar condition, and will, of course, break off and fall out much more profusely than under more normal conditions. This tendency may be arrested by trimming the ends of the hair.

The Pulling Treatment.—To strengthen the hair, and bring the blood to its roots in liberal quantities, pull it slightly all over the scalp. This slightly raises the scalp from the skull, and at every point where the scalp is thus raised, the circulation is greatly accelerated, causing the hair to assimilate its food more readily.

Nothing gives the scalp the sensation of being so thoroughly and effectively awakened as does this pulling process.

The proper way to massage scalp and remove dead hairs by this pulling process, is to insert the spread fingers into the hair as you would a comb, closing them tightly together as they are passed through it. Every part of the scalp must be treated thus; this method not only strengthens the roots and removes all partially dead hairs, but if the

"finishing touches" to the drying process after washing is done by pulling the hair evenly over the entire surface of the scalp, it gives the hair a luster and wavy appearance that can be acquired by no other method.

Dead hairs should never be allowed to remain in the scalp; they should be plucked as soon as they can be easily removed. Under these circumstances, if they are removed another hair *always grows* from the same follicle or root sheath; but if this dead hair is allowed to remain until it falls out of its own accord, it often kills the root, and the hair never grows again. Therefore, when hair shows an inclination to come out in excessive quantities, the first duty is to pull out all that can be easily removed—for, if a spear of hair can be removed with a slight pull, life has become extinct, and the sooner it is removed the better. If the hair is dead, or partially dead, it will come out anyway in time, and why not be rid of it at the earliest moment, and give the root a chance to live and sprout a new hair?

How to Massage the Scalp.—The remedy par excellence for stimulating hair growth and hair nutrition is a systematically and scientifically applied massage of the scalp. Naturally, the effect will be more marked when the treatment is applied by a well-trained masseur. With a little care, however, and a good deal of will, the method can be acquired by anybody, and one can treat himself with very good results. To accomplish this, first remove all clothing down to the waist line; this will give you a freedom of movement of your arms which you cannot obtain in any other way and which is essential for carrying out self-treatment.

In massaging with the hand, first rub the entire surface of the scalp with the ends of the fingers in order to increase the circulation generally.

Now grasp with the open hands the back of your head and pressing firmly upon the scalp, move it forth and back upon the skull about ten or fifteen times. The same exercise is repeated with the sides of the scalp and with its frontal part. The next exercise consists in trying to grasp folds of the scalp between the thumb and index finger of each hand, and rolling it between them. This exercise, which might also be described as pinching the scalp, is practiced for about five minutes and must cover the entire scalp.

Washing the Hair and Scalp.—Authorities differ as to the frequency with which hair should be washed, some advocating this should not be done more than once a month, basing their opinion on the nature of

the hair, which enjoys a constant natural bath of perspiration and oil. But when it is recalled that the scalp, as a part of the skin, accumulates scaly waste, excess of deposits from the perspiratory and sebaceous glands, and ordinary dirt and dust, cleansing more frequently than once a month is necessary.

The intervals to elapse between each washing should be determined chiefly by the amount of oil supplied to the hair. If the oil is very abundant or if the scalp is exposed to much dust and dirt, the hair may require two or even three shampooings each week. Usually, however, a man's scalp can be kept in condition by shampooing it once weekly, whereas a woman's scalp needs a shampooing only once in two weeks.

In shampooing, the scalp is first slightly wet with warm water. A small quantity of the soap solution is then applied and vigorously rubbed into the scalp. From time to time, sufficient water is added to make a good lather.

Most of us know that in washing the head the object is not so much the cleansing of the hair itself as the scalp. It is important to rub the scalp well with the finger tips, by dividing the hair as it is done for brushing. Be careful to use only the finger tips and not the nails as they might scratch and irritate the scalp.

The lathering is followed by rinsing the scalp, first with warm, and finally with cold water.

Drying the Hair.—After each shampooing the hair must be dried thoroughly with towels. A soft, absorbent towel should be used. To avoid entanglement, the hair should be taken up in strands and rubbed with the towel until completely dry from the hair-roots to the ends.

Exposure to the heat of the sun and fanning will hasten the drying process; but it injures the hair to dry it by the use of hot air. Long hair must not be braided until perfectly dry.

Special Treatment for Stimulating the Scalp.—The treatment here described is of special value in baldness, excessive falling of the hair, and where the hair is very thin. When the hair is in normal health, it is hardly necessary to use it. The use of hot and cold water, alternating from one to the other, is about the strongest stimulant to the circulation of the scalp that can be used.

The hot application draws the blood toward the surface; the cold drives it back and onward in its travels to the heart, thus actually creating practically an independent and vastly accelerated circulation

of the blood wherever used, and this treatment of the scalp unquestionably results in greatly stimulating the hair growth.

The best time to treat the scalp in this way is immediately after shampooing. Have the temperature of the heated water as hot as can be borne and the other as cold as possible without using ice. Hot and cold wet cloths can be applied in the same way. This latter method is better in case the hair is very thin or a bald spot is being treated. The change from hot to cold should be made from six to ten times during each treatment. Each application should be allowed to permeate the entire surface of the parts treated before changing to the other.

Soap for Shampoo.—Various soaps have been recommended for shampooing. The chief requisites of a soap for this purpose are that it be easy of application, free from irritating and harmful ingredients, and that it form a good, stiff lather. A solution of 10 per cent. pure castile soap in diluted alcohol answers requirements. Occasionally, when the scalp is beginning to harden, a good tar soap is preferable. On a very dry scalp a tincture of soapbark can be substituted for soap. It will remove dust and dandruff but will not dissolve oil.

Nearly all the liquid shampoos sold are too powerful, especially for frequent use; and though they do remove dirt and grease, they sometimes remove too much of the natural oil, causing the hair to become dry and brittle.

Soap containing a large percentage of alkali should not be used. The use of the egg for shampooing is very highly thought of. It has been suggested that the blonde use white of egg and the brunette the yolk. For an ordinary shampoo for either type, the part of egg to be used should be beaten up with a little water and rubbed into the scalp, which should then be thoroughly rinsed in slightly warm water to remove any of the egg that may be clinging to the hair. Where, however, a more effective shampoo is desired for cleaning purposes, a tablespoonful of a jelly made by boiling some pure castile soap shavings in water, should be beaten up into the yolk or white as the case may require, and applied as before.

Brushing and Combing.—The value of brushing the hair regularly and thoroughly can hardly be emphasized too strongly. It polishes the hair, and tends very greatly to increase its luster, but the principal value of the brush lies in the influence of its proper use upon the scalp. It should be brushed back and forth on each part until the circulation has been rapidly accelerated to the surface. As a means of

accelerating the circulation of the scalp, hair brushes are of equal, if not greater, value than the brush used on other parts of the body. Furthermore, the proper use of the brush serves the very valuable purpose of ridding the scalp of dandruff and other matter which tends to accumulate.

Care should of course be used in the selection of a proper brush. The bristles should be of a proper degree of stiffness, and should be of even length; they should be of even thickness throughout the entire surface, in order to induce proper friction in every part. If some of the bristles are longer than others, they will frequently scratch the scalp.

In the case of men the hair can be best brushed with a pair of brushes, one being held in each hand.

Great care must be exercised in brushing a woman's scalp in order to avoid unnecessary tearing of hair. Here the hair is parted successively at different places and the exposed scalp is briskly brushed. By repeating the process a sufficient number of times the entire scalp may be gone over.

Some women prefer to use a brush with stiff bristles for removing dandruff, and then use a soft one for polishing and arranging the hair.

Combing the hair is beneficial for two especially good reasons. It assists in the polishing process, and gives the hair roots the benefit of the massage and strengthening influence secured from the slight strain upon the roots.

Dandruff.—The existence of dandruff does not necessarily indicate a diseased condition. A certain amount of dandruff is always present, even in the most healthy scalps. In fact, dandruff is nothing more than particles of the scarf skin, the accumulation of dirt and other minute atoms, and the refuse from the oil glands, which adhere to the scalp. The necessity for proper cleanliness, in order to avoid any possible deleterious effects from this constant accumulation, is quite apparent.

Where dandruff is allowed to accumulate in excessive quantities it is liable to produce a number of very irritating diseases. Eczema is frequently produced largely by causes of this nature. When dandruff appears in large flakes, or is excessive in quantity, immediate efforts must be made to bring about a normal condition.

Many believe that washing the scalp creates dandruff. But this false conclusion is very easy to disprove. Where the quantity of dandruff falling from the scalp apparently increases when the scalp has been

cleansed, it simply indicates that the cleansing process has released the dandruff from the scalp, and consequently it appears in greater quantities.

Regular shampooing of the scalp, massage and brushing will prevent the excessive accumulation of dandruff.

Gray Hair, Premature—How to Remedy.—The hair obtains its color from the coloring glands situated nearer the surface than the hair root. When these glands are impaired or destroyed by old age or any other cause, the hair naturally loses its color.

Hair will frequently turn gray, even in early youth, from nervous shocks and other abnormal influences. A youthful face accompanied by almost white hair can be occasionally seen. The fact that the hair is turning gray does not in every instance indicate that it is losing vigor. The hair roots may be as capable of nourishing the hair as before.

The hair usually begins first to turn gray over the temples near the ears, then gradually creeps to other parts of the head. Frequently when the hair begins to whiten it begins to fall in greater quantities, and especial care is needed under these circumstances to avoid permanent loss. Where hair has turned gray from general physical causes—decline in health, nervous troubles, and the like—it can in some few cases be brought back to its original color by the means necessary in the building up of the general health and by the careful use of local treatment.

A preparation consisting of yolk of an egg with a few drops of chloroform worked to the consistency of paste is recommended for lack of color of the hair. This preparation should be applied to the roots of the hair, and after remaining for a half hour or more should be carefully washed off with some warm water.

Even people with an abundance of gray hairs need not despair. Systematic massage of the thyroid gland has stimulated the growth of patches and streaks of black hair over the head. This may sound strange to the average layman, but to the professional man who knows what a powerful influence the internal secretions of the thyroid gland have upon the functions of the system, it seems not at all physiologically improbable that the vital influences of the gland may extend even to the nutrition of the deepest layers of the hair roots where the pigment cells of the hair originate. To stimulate the action of the thyroid gland the central portion of the neck below the "Adam's apple" should be stroked with a side-to-side and up-and-down motion

for about two minutes daily. People suffering from palpitations of the heart or exophthalmic goiter should avoid this exercise.

Dry and Brittle Hair, Treatment for.—At times there is an insufficient supply of oil. Often this is due to the collection of dust upon the scalp. The dust particles clog up the pores and prevent escape of sebum, which accumulates within the gland and distends it; the gland becomes inactive and if the condition is not relieved, it atrophies or dies. The pressure of the distended gland upon the hair root interferes with its growth and nutrition. On the other hand, the lack of oil manifests itself in the dry appearance of the hair. Such hair loses its luster and waviness, becomes brittle and begins to split or break.

Cocoanut oil, carefully applied once daily with the finger tips to the scalp, is recommended for hair which is abnormally dry. Other local treatment in the way of vigorous brushing twice daily, massage, general care of the hair will remedy the condition. When the hair is very dry it should not be washed more than twice monthly. After every shampoo cocoanut oil or sweet almond oil should be rubbed into the scalp.

Remember, it is the scalp, and not the hair, which is to be treated with oil. This can be best accomplished by dipping the finger tips in oil and rubbing the scalp gently, first parting the hair so that the scalp can be reached, and so avoiding the unsightly greasy appearance not infrequently observed in the hair of some persons. Where the dryness has progressed to the stage of brittleness and the hair splits and breaks in places, it is further necessary to clip the hair short and to keep it short for months.

In the case of dry and brittle hair, brushing, massaging and other treatment should be at first gently applied; as the growth and quality of the hair improves, the treatment may be made more vigorous. Of course, as in all hair and scalp troubles, the general health should be given attention.

Dull hair is due to lack of natural oil. The same treatment advised for dry hair to be followed.

Eyebrows and Eyelashes.—The fact that eyebrows and eyelashes can be strengthened and made to grow thicker and longer is not generally known. Proper care will greatly improve them in every instance, and the possibility of losing them under such circumstances is hardly worth considering.

Once each day, or at least two or three times a week, all the hair of the eyebrows and eyelashes should be slightly pulled several times,

thereby removing all partially or entirely dead hairs, enabling the new hairs to appear, which in nearly every case are stronger than those removed.

Great care should be used to avoid pulling the eyelashes too strongly, at least during first attempts. Do not be in the least alarmed if a great many hairs are removed in the first few times this process is practiced, for a new hair will grow for every one removed. The hairs that remain under these circumstances will also grow stronger under the influence of this method and should therefore grow longer, giving both the eyelashes and the eyebrows a more pleasing appearance.

In pulling the eyelashes, a number should be caught, say of the upper lid, between the finger and thumb, pressing slightly on the hairs as they are pulled outward. The same process can be used for the lower lashes and the eyebrows. Kneading and massage are also of benefit in many cases.

Applications of any kind are of no value in improving and strengthening the hair of these parts. The natural processes here advised are the only means that can be relied upon to bring about satisfactory results. The most common troubles are scanty and ill-shaped eyebrows. These conditions may be greatly improved by the use of either vaseline, almond oil, or lanolin, together with a small brush. The oil will promote their growth. And if the brows are light in color, the oil will help to darken them and make them more conspicuous and the brush will smooth them and train them in the right direction. Where the brows are coarse and unruly it has also been found beneficial to brush them as they should lie with just a touch of a mucilage made of quince seeds and rose water. It should be applied at night, and in the morning washed off with a little warm water, care being taken not to rub the hairs the wrong way. This roughens them and causes them to break. It should be remembered when treating the eyebrows to observe the greatest care and to use only small quantities of any preparation.

Curling.—Women are warned against the evil practice of curling and crimping the hair. Because the hair shaft is not supplied with nerves of sensation does not imply that it can be tortured with impunity. Roasting the hair is just as bad for it as scorching the finger nails (to which it is similar in nature) would be for them.

Bleaching the hair with strong caustics is even more destructive of its health and vitality than the use of the hot curling iron. It is as absurd to think such a treatment harmless as it would be to attempt

to remove the color from the lips and cheeks and expect health to remain.

Dyeing.—Hair dyes of all kinds should be avoided. The natural color of the human hair, regardless of what it may be, if properly cared for, cleansed and polished daily, is far superior in color to what it can be made to assume by the application of any dye. All these dyes will injure the hair.

Hands, Care of.—Next to the face the hand is the most expressive part of the body, and so requires especial attention to make it a desirable exponent of character. Well-kept hands have in all civilizations been regarded as the crowning evidence of culture. "Polished to the finger tips" is a well-known phrase of the Latin poet Horace; it is certainly most eloquent.

Unfortunately too much attention to nail polishing and too little to the development of the muscular structure of the hand has been paid of late by professional beauty culturists. The modern manicurist, a term derived from the Latin words *manus,* hand, and *cura,* care, utterly neglects the hand itself in her work. As William A. Woodbury, the dermatologist, said: "She ought to take down her sign 'Manicurist,' and hang up instead one labeled 'Nails Shined Inside.'"

Physiologically the hand is a marvelous mechanism in its complex adjustment of anatomical forms to special purposes. Bones, muscles, ligaments, nerves, arteries and veins are combined most delicately and ingeniously to form the greatest tool in creation. And, as it is the mark of a good workman to take care of his tools, it is the index of a sensible man or woman to keep the hands in proper condition, since we are all, in one form or another, manual, that is, "hand-using" laborers.

The first duty in caring for these valuable tools is to keep them clean, that is, really rather than apparently so. Gloves are a frequent substitute for cleanliness, and when so used, form its worst foe. As a rule, the hygienically important part of gloves, the inside, is rarely cleaned, and so the wearing of them nullifies the effect of washing the hands by keeping these in constant contact with dirt, and that of the worst form—the effluvium of the body.

Chapped Hands.—Although worn to prevent chapping, gloves are in fact a chief cause of this disagreeable and unsightly condition. Chapped hands are simply soiled hands, hands where the dirt has worked into the skin and set up an irritation. They are best treated with a mixture of cornmeal, shaved castile soap, and warm water, with

a little olive oil or vaseline rubbed in afterwards. In obstinate cases a little lemon or lime juice may be used with the oil.

If olive oil is rubbed into the hands when these are about to be submitted to conditions which may produce chapping, it will do much to prevent it.

Roughened Hands.—In the cases of lean hands and hard, coarse hands in which the skin is lacking in oily secretion, the application of olive oil from time to time is advisable. It may then be properly denominated by that much abused term "skin food," since it supplies lacking element to the epidermis. Otherwise it is unnecessary and since dirt is defined as "matter out of place," it will only prove an aggravation of the evil it was intended to remove.

Healthy Hands, Applications for.—Normally healthy hands require no other applications than of warm water and vegetable soap, or cornmeal or oatmeal. The use of oatmeal as a cosmetic cannot be overestimated. Its effect upon the skin is most soothing as well as nourishing. It is prepared as follows: Boil some good oatmeal in water for an hour, after which strain and use the liquid as a wash. It is an excellent softener, but it must be prepared in small quantities, as it soon becomes sour. The following preparation will also be found useful for whitening and softening the hands: Melt together equal parts of cocoa butter, oil of sweet almonds and refined wax; then stir the mixture until cool. Apply before retiring.

Massage.—For developing and beautifying the muscular structure of the hands, massage is very beneficial. This should be done with lengthwise movements. Each finger, after the skin has been softened with cold cream or olive oil, should be rubbed from the tip to the base, and the tip should be gently pinched at the side to make the finger, usually flattened by occupation, return to its natural tapering form. The back of the hand should be rubbed in lines extending from each knuckle to the wrist, with intermediate light pulls or pinches crosswise. The palm should be massaged toward the fingers also, with intermediate rotary movements toward the center of this part of the hand.

Massage for Enlarged Finger Joints.—Massage is also useful in reducing enlarged joints, that is, apparently doing so by developing the fleshy structure contiguous to them, so that a more rounded contour of the hand is produced. It is only, however, when the enlargement is caused by occupation that massage should be used. When the trouble is due to chalky deposits, the operation is painful. The proper

treatment of such cases is dieting, since the deposits are the result of eating meat, drinking alcohol, etc.

Massage for Nervous Weaknesses of Hands.—Massage is decidedly helpful as an auxiliary of constitutional treatment in curing twitching of hands and twiddling of thumbs and the excessive perspiration which often accompanies these indications of a nervous condition. As a relief for the perspiration the hands may be covered overnight with a fine cornmeal or rice powder.

Toilet Preparations for Hands.—As a rule all powders and toilet preparations, skin bleaches, skin foods, etc., are to be avoided, as in time they dry up the skin by combating and hence discouraging the natural perspiration of the skin through the pores by which the proper secretions are supplied as well as waste matter eliminated.

Manicuring.—It is essential for rightly treating the nail, to know its anatomy and physiology. Very few of even the professional manicurists are acquainted with even the simple fact that the nail is a skin formation, continuous with the cuticle and arising from the true skin which nourishes it. Accordingly they treat it as if the skin had no other relation to it than the mechanical one of container or setting.

Nature strives to have each nail conform to the shape of its finger. It should therefore be the aim of the manicurist to aid this purpose, not to combat and nullify it. Thus fanciful shape for nails which have been in vogue in the profession, such as the "rose-leaf," and "shield," and "talon," are abhorrent both to common sense and taste. It is vulgar to thus parade one's nails.

The special instruments used in manicuring are few and simple: Clipper, cuticle scissors, flexible steel nail file, steel cuticle knife, buffer, emery board, nail brush and orange-wood stick, and the special preparations are still fewer, consisting of rather unnecessary nail bleaches, powders and creams.

The first step in manicuring is the thorough massage of the fingers, the next the trimming of the nails, then the cuticle is pushed back from the base of the nails, and finally the nail is rubbed or polished to a rosy glow.

Improper methods of cutting the nails are often responsible for badly shaped finger tips. The nails act as a support for the flesh, and if they are improperly trimmed the result will be that the flesh, having nothing to cling to, will sag, and a flat, thick tip will develop. Those who have naturally wide nails should not try to cut away the sides in an effort to make them appear narrow and pointed. This is not

only useless but harmful, and will end by making the tip of the finger thicker than it was. The nail should not be cut too short, for the same reason. If the nails are brittle and break easily, their condition can be improved by soaking the finger nails in warm olive oil for about fifteen minutes every night before retiring.

The file is preferable to the scissors for cutting the nails, as cutting thickens the nail and causes it to lose its transparency. The use of the file is very quickly learned and much better results obtained. In filing the nails, the file is held between the nail and the flesh and not at right angles with the nail. Care must be taken, however, not to go too far into the corners or the result will be the thick tips mentioned as the outcome of improper trimming.

Never do any work on the cuticle at the base of the nail unless the finger tips have been soaked for about five minutes in warm, soapy water in order to soften the skin. If the cuticle is pushed back without having been previously softened by the soapy water it is apt to break or tear in the operation and cause "hang nails."

The very best way to loosen the cuticle is to bathe the finger tips in olive oil; about five minutes will usually be sufficient to soften it, so that it can be pushed back with an orange-wood stick, with proper care; but if the nails are very much overgrown do not persist; instead give them another oil bath. If there is quite a ridge of skin formed at the base of the nail after it has been pushed back, it may be necessary to clip a little off with the rounded scissors made for the purpose, but only a very little should be cut. Cutting tends to thicken the cuticle, therefore it is better to push it back, with only an occasional trimming. Such treatment will cause the "half moons" so necessary to insure that the nails are well defined.

Now, after treating the base of the nail, wrap a tiny bit of cotton about the pointed end of the orange-wood stick; dip into peroxide of hydrogen, and clean the outer rim of the nail. Clean the nail only, don't rub the skin under it, as it will cause the skin to become ragged and uneven, thus forming little crevices for the dust and dirt to cling to, which will result in unsightly dark rims around the finger tips. It is for this reason that sharp-pointed instruments are to be avoided for cleaning the nails.

Finally polish each finger nail with a buffer, or an ordinary piece of chamois. Three or four strokes will be sufficient, as a very high polish is not in good taste.

About a month of the treatment advised will bring about a great

improvement in most cases, and in order to keep the hands in the condition attained they should be carefully manicured at least once or even twice a week.

Brittle Nails.—Nails, like other parts of the body, suffer from ill-health, which is indicated by their appearance and condition. If there is a lack of lime in the system they become brittle. The constitutional remedy is, of course, a resort to proper diet. This may be aided by a local treatment of the nail with a mixture one-half of which consists of white wax, and the other half of equal parts of salt, resin and alum, melted together with the addition of a little almond oil. This treatment is also effective in the case of ridged nails. Do not use polishing powders upon nails in ill-health, and avoid varnishes, rouges, etc., for nails in any condition.

White Spots.—White spots may be removed by applying overnight a mixture of equal parts of refined pitch and myrrh. This should be removed in the morning with the aid of olive oil.

Bruised Nails.—A bruised nail may be kept from turning black with clotted blood by immersing it for half an hour in water as hot as can be borne, and wrapping it overnight in cotton soaked with witch hazel. The finger should not be used for a day or so after this treatment.

The Skin and Its Care.—The skin is generally conceived to be a simple covering for the body, an outer garment of tissue which serves to enclose and protect the parts within. It does all this, but its functions are far more extensive and elaborate than merely giving shape and form to the body. Roughly the skin may be divided into two portions, the deeper layer, called the *corium,* or *derma,* or true skin; and the outer layer, called the *cuticle,* scarf-skin or *epidermis.* This outer layer is merely composed of dead cells; is unfed by arteries or nerves, and consequently lacks sensation. It serves to protect the under skin from contact with solid substances, which would otherwise prove painful, as we discover when we abrase our finger. Although it may appear at first sight an unnecessary appendage to the body—this outer layer of dead skin—it is, nevertheless, one of our greatest protectors, since whenever it is removed it is possible for us to acquire, upon contact, various blood diseases from which the epidermis protects us.

The skin is very complicated in its structure. Besides the layers before mentioned, there are thousands of sweat glands and ducts scattered throughout it, and an elaborate arrangement for supplying and feeding the hairs throughout the surface of the body.

The *color* or complexion of the skin depends upon its outer or epidermal layer. If this were entirely removed the surface would be of almost a blood-red color, owing to the abundant blood vessels found everywhere in the corium.

The difference in color between the blonde and brunette is due to the pigment which lies in the scarf or outer skin. Even in the whitest skins this pigmentary principle, though to a much less degree, is present. Thus the different shades of color seen in people depend upon the amount and depth of hue of the pigment contained in the granules of the epidermis. In the darker races these granules are of a dark yellow, approaching to almost blackness in the negro. In the fair inhabitants of the North they are pale. The heat of the sun increases the formation of the pigment, which explains why in summer exposed parts of the skin become brown, while in winter, this stimulative factor being absent, and the summer epidermis wearing off, the light complexion is renewed.

The blood and nervous structure of the skin is highly complex. Sweat glands situated throughout the body act as excretory organs, and are shaped like corkscrews. At some distance below the surface of the skin this corkscrew-like tube ends in a gland which resembles a coil of the tubing roughly thrown together. The little sweat-gland tubes are exceedingly minute, being, it has been computed, but one-four-hundredth of an inch in diameter; while the number scattered throughout the body would amount to something like two million, four hundred thousand!

Although this brief anatomical description of the structure of the skin may not seem at first sight to bear directly upon the complexion and its preservation, it can be shown that this is so, nevertheless. For, when we know that the glands situated on the surface of the body are not straight tubes, but twisted or corkscrew-like, and are not short, but on the contrary of great length, comparatively speaking, we at once see the fallacy of attempting to rub various greases and "skin foods" in, with the idea that they will be absorbed into the circulation, and so help nourish the parts. All the "nourishment," in such cases, comes from the added blood supply, which is brought to the part by the massage, and the so-called "skin food" can add nothing permanently in the way of healthy tissue. The skin being an excretory, and not an assimilating organ, it is impossible for it to absorb material from the outside; for it is specially constructed in order to allow all solid matter to pass in one direction, while forbidding it to repass in the other.

Were this not the case, the skin would be constantly absorbing into the circulation all kinds of foreign and poisonous elements, whereas its chief duty is to prevent their ingress. All that greases and "skin foods" can do, therefore, is to stimulate the circulation; or, by blocking the minute orifices of the sweat glands, to cause an artificial retention of material, which material, as a matter of fact, should be eliminated! The fallacy of using such preparations is therefore obvious.

Powders.—The best application for removing greasiness of the skin is pure *rice powder.* A certain amount of friction daily applied to the face will serve to keep the pores well open and prevent the formation of red spots, blackheads, etc., so frequently seen. An excellent way of flushing the pores of the skin of the face and head is to hold the head over a jug of boiling water, to which has been added several tablespoonfuls of eucalyptus oil. If the head be held in the steam and covered over with a thick towel, it will soon break out into a profuse perspiration—an excellent treatment also for colds in the head.

Many health-reformers contend that *soap* should never be applied to the face. The truth is, it all depends upon the soap. If this be pure and harmless in character, there is no reason why the face should not be washed in soap and water, as is every other portion of the body. In fact, it is quite possible that much of the skin trouble that arises on the face is due to the fact that soap has *not* been used. Several authorities on the skin agree in recommending pure Castile soap as the least harmful, and most cleansing in its action. "Medicated" soaps are, as a rule, a farce.

Massage of the face will be found exceedingly beneficial in certain cases, invigorating and strengthening the skin. Care should be taken, however, that massage is performed by an expert, or at least by one who knows the direction of the underlying muscles, for if the face be not massaged in the proper direction, more or less disastrous results will frequently follow. The face should be gone over each morning with a flesh brush, scrubbing equally all parts of the face, reaching every corner. Alternate hot and cold compresses applied to the face have been found to relieve long standing skin trouble, and almost instantly clear the complexion. A certain amount of sunshine upon the face will prove beneficial; but this should not be overdone, since recent experiments have shown that an excessive amount of sunlight is exceedingly harmful to all living protoplasm, the tendency being to destroy the healthful tissue, if too long continued.

Some authorities on "beauty culture" assert that an excellent method of massaging the face, and one that is quite harmless, is to twist and pull the muscles about in all directions, not with the hands, but by means of the muscles themselves; that is, they advise the patient to "make faces." There is no reason why this practice should not prove beneficial, adding to the flexibility and elasticity of the muscles, and stimulating the blood supply to the parts. Five or ten minutes' daily practice should improve the character and texture of the skin in almost every case.

It will be seen from this that the two practices necessary to keep the skin in health and beauty are: cleansing, to remove all impurities and keep the pores free, and friction, to induce a life-giving circulation. Back of these, of course, lie proper diet and general bodily exercise, which have been discussed in other parts of this work. It will not be superfluous, however, to introduce here a few remarks on diet as specially intended to produce a beautiful complexion. A diet of uncooked foods, for instance, has many features that are of very great value in cleansing and improving the color and general character of the cuticle.

Perhaps about the best diet for quickly changing the condition of the skin is that in which the food consists solely of milk. The milk diet flushes the entire functional system—the arteries, the capillaries, the veins, and all parts of the tissues—with a new supply of nourishment, rich in all those elements needed to revivify the body. A muddy complexion assumes the pinkish tint of youth after its possessor has followed a milk diet but a few short weeks.

Chapped Skin.—This is due to two causes—the internal nutrition and the external atmosphere. If the food be lacking in food salts, this may cause the hands to chap. An abundance of fresh fruits in the diet will prevent this. Meat should be avoided for some days, when chapped hands first appear. An abundance of soft water is essential.

The hands should be washed in warm water, rinsed in cold, and *thoroughly dried.* This latter point is very important. A soft alkali soap should be used, though it would be better to use no soap at all for a few days, if possible. Rub the hands with olive oil every night, and on arising in the morning. It would be a good plan to place the hands in old gloves, at night, after rubbing them with oil, to prevent the sheets from becoming soiled. This will also protect the hands more fully.

Dry, Scaly Skin.—Dry, scaly skin should be massaged with olive oil, or cocoa-butter, since the cause of the condition is a deficiency of the natural sebaceous or oily secretion. On the other hand, oily skin and enlarged pores, which are due to an oversupply of this secretion, should be massaged without oil, and, in extreme cases, with lotions consisting of rosewater, milk of crushed almonds, and a little alum, the almonds and the alum having astringent properties.

Eating oily and fatty foods for a time will doubtless help this condition. The milk diet might prove very beneficial in this case. Be sure that the bowels are kept open. When following an ordinary dietary, plenty of water should be used. Acid fruits are beneficial. Exercise in the fresh air. Keep the skin open, by water applications and Turkish baths.

Enlarged Pores.—A condition usually noted on the face, and causing inconvenience because of its unsightliness. The treatment consists chiefly in opening the pores all over the body and deterring the expulsion of impurities, as much as possible, through the pores of the face.

Frequent Turkish baths would prove beneficial in a case of this character; also frequent hot baths. Alternate hot and cold cloths to the face would be advisable, always ending by the cold cloth, which may be applied like a pack. Some mild astringent may be employed, to contract the skin, though this should not be too strong. Avoid all greasy foods and drink plenty of lemonade and acid fruit-juices. Take good care of the general health, including plenty of active exercise.

Moles.—For moles the electric treatment is necessary if one considers these marks, which properly are not diseased conditions, to be disfiguring. Like sunburn and freckles they do not affect the health, and are therefore not offensive to the person who has the right idea of what constitutes beauty. Where facial disfigurements are abnormal, as in the case of birthmarks and superfluous hair, their victims cannot be blamed for desiring their removal. Skilled operators of the electric needle can do much in remedying these.

Moth Patches.—(Chloasma.)—This is a form of discoloration of the skin. It may be a species of pigmentation, in which case nothing can be done to cure it. Patches of this kind sometimes coincide with pregnancy, or follow it; in which case the marks may, to a certain extent, be removed by a truly hygienic mode of life, combined with great abstemiousness.

Liver Spots.—See Volume II.

Pimples and Blackheads.—The method usually followed in removing a pimple is to squeeze the tissue to such an extent as to force out the matter that usually accumulates within it. This in many cases will remove the defect, though a red spot often results, and in some cases the pores of the skin about the affected part are thus permanently enlarged. Blackheads are frequently removed in a similar manner, that is, the tissues are squeezed to force out the matter or pus which usually forms the blackhead. This also, in nearly all cases, results in permanently enlarging the affected pores of the skin.

An excellent means to prevent pimples and blackheads is with dry friction. To treat the face in this manner, secure an ordinary complexion brush and brush the skin of the affected part up and down, back and forth, from side to side, and diagonally, continuing the process until the skin is very red from the acceleration of the circulation of the blood brought to the surface by the friction.

Even in those cases when this treatment does not immediately eliminate all blackheads or pimples, if continued two or three days you can rest assured that the eruptions will disappear. This friction incurs no bad after-effects. The skin is cleansed and improved by the treatment.

If one has a large number of blackheads or pimples it is sometimes a good plan to steam the face. This, of course, softens it and enables one more easily to remedy the disfigurements referred to. It is usually a good plan to first of all give the face a dry friction bath with a complexion brush, or a rough towel, then to give the face a steam bath, which should be followed by massage, kneading all parts of the face slightly, but giving special attention to the affected parts.

After massaging the face (or during the massage), a good grade of cold cream could be used, or what is better still, olive oil with the greenish color removed. All this tends to accelerate the circulation to the affected parts, very thoroughly cleanses the pores, softens the tissues, and is inclined quickly and radically to remedy disfigurements of the skin.

Florid Complexion, Red Nose, etc.—An excess of blood in the face is the cause of these conditions. This itself may be caused temporarily by one of several things and the condition will become chronic by making the cause a habit or by allowing it to continue for a considerable period of time. Alcoholic beverages were formerly a common

cause and still are in some instances, but there are other causes. Hot beverages and hot soups will flush the face. Constrictions about some part of the body, as tight collars, gloves, corsets, girdles, belts and shoes will force extra blood to the face. Long and frequent exposure to sun, wind and harsh weather conditions is frequently responsible for too ruddy hue, as these cause congestion of the blood vessels, which may in time become chronically dilated and congested. Plethora, high blood pressure and organic heart diseases are conditions that produce floridity, the degree of which depends upon the degree of the causative condition. And of course certain skin diseases and certain abnormal conditions of the nerves of the skin affect the complexion in this manner. The same conditions that so injure the complexion as a whole will cause the nose to redden, though digestive disturbances, and especially dyspepsia, are a frequent cause of red nose. Insufficient clothing on cold days and the pressure of eye-glasses are also occasional causes.

Naturally the cause must be found and removed, when possible. Remember that these troubles are circulatory defects and are not due to troubles in the skin itself. If the blood is kept from one part it must go to another and constriction, even of tight gloves, must be avoided; also, if the circulation is overstimulated or if the blood is retained in one part too long there will be a congestion that will in time become chronic, if the circulation is not normalized. Local applications of salves, lotions, etc., will be disappointing in results so long as the cause remains effective; but cold water applications or alternate hot and cold applications, with perhaps *gentle* massage, will help in those conditions not due to organic heart diseases or high blood pressure. Definite steps must be taken to remedy these by a strict regimen, such as described for them in Volume II. In any case, general treatment will be necessary for most prompt and satisfactory results.

Sunburn is a painful affliction against which anyone who has naturally tender skin would do well to take adequate precautions. The effect of the sun upon the skin varies according to the texture of the cuticle; thick skin tans, the oil and thickness of it offering a greater resistance to the sun so that it cannot burn quickly enough to blister. On the other hand, thin and dry skin becomes red, blisters and peels.

Bathing and swimming can be indulged in without injurious sunburn if the face, neck and shoulders, and even arms and hands, be

given a *temporary* coat of pure cold cream, the grease protecting the skin. This can be applied so as not to be objectionable if the cream be rubbed well over the parts, and then lightly dusted with a pure rice powder.

A good cream for this purpose is made of one ounce of white wax; four ounces of almond oil; one ounce of spermaceti. This treatment is especially good for those having delicate skins, upon which the action of sea water is particularly injurious. Upon emerging from the bath a toilet water or solution of borax should be used *at once* to remove all of the grease.

In the event of this precaution not having been taken, one can do much to alleviate the pain resulting from the exposure by applying cold wet packs to the affected parts. It is more convenient to apply these packs at night. If the burn has extended over a large surface an article of clothing worn next the skin can be wet and worn at night.

Chapped lips are readily cured by rubbing with mutton tallow, or by applying cold cream nightly to the lips before retiring.

Freckles.—A few simple directions for removing these are as follows: Prepare a lotion of one ounce of lactic acid, one ounce of glycerin and six ounces of rose water and apply this with absorbent cotton two or three times a day. Applying the juice of a lemon to the face daily is also advised for the same purpose.

Wrinkles are not really an affection of the skin, being due to the lack of adipose tissue underneath the skin. In the case of wrinkles of the brow and about the eyes they are often signs of mental condition. Concentration of thought leads to the sympathetic contraction of the muscles of the brow, with the result that wrinkles become a permanent index of the habit.

In a great number of cases, worry is the greatest cause of wrinkles, and unless you expel from your mind this, its greatest enemy, you will be merely wasting your time by trying to get rid of wrinkles.

But wrinkles are also due to physical causes, such as defective circulation and innutritious diet, which, by lowering the vitality of the system, are unable to expel from the tissues those dead cells that in perfect health are eliminated, and so cause anemia, or impoverishment of the blood, and emaciation. An improper diet will generally be indicated by constipation, the result of which is the retention in the system of waste matter that breeds poisons. You cannot expect to have a clear, smooth skin with your body reeking with impurities.

With wrinkles comes the appearance of old age. They make one seem much older. With their removal there is always a decided change. One appears younger and more vigorous, more alive and awake. Wrinkles and senility are very closely associated.

In the case of wrinkles it is always better to prevent their appearance than to cure them, once they have appeared. A little care as to diet, and proper massage of the face, coupled with such exercises as are calculated to strengthen the face and neck muscles will keep the face young and fresh looking, as many have proved. There is no inevitable cause why wrinkles should appear with old age; and the fact that they *do* is only another indication that the organism has not been properly cared for during the earlier years of life.

Should wrinkles appear, however, the harm is done, and the next thing is to get rid of them! The pores of the skin should be kept active, by means of hot and steam face baths, etc., so as to make the muscles soft and pliant. They should then be carefully rubbed and massaged by means of the hands, *in the direction of the muscles of the face*—and upward, and *never* downward or crosswise, to any extent. Small balls are used for this purpose, and will be found very efficacious. The Japanese use a specially constructed "massage ball," which is very good in a number of cases. You must study the anatomy of the muscles of the face if you wish to treat your own face, though it would be far better to have someone else (a skilled operator, preferably) treat your face for you, if possible. After the treatment it would be a good plan to rub the face with buttermilk. This will be found very beneficial, and will keep the skin soft and in good condition.

In the case of newly formed wrinkles, the following application has been found effective: Strips of soft linen are dipped into the white of an egg, and after being smoothed out, are placed directly over the wrinkle and allowed to remain about five minutes. A rather strong astringent that will draw together the loose skin will be found in the following: Rosewater, six ounces; elderflower water, two ounces; tannic acid, ten grains; tincture of benzoin, one-half ounce. When using benzoin to beautify the skin, do not use compound tincture, which contains other ingredients which are unsuitable for the purpose. Ask for simple tincture of benzoin. Vinegar and alcohol are also generally employed as astringents, but they dry the skin and impair its nutrition.

Warts may be removed by the treatments of the electric needle

or the stick of lunar caustic, or by moistening daily with carbolic acid, but, as these are apt to leave small white scars, it is best to remove their cause by adopting a careful diet and keeping the skin scrupulously clean. Drinking a tablespoonful of lime water twice a day will often prove beneficial.

Teeth, Care of.—There is no feature in which health and beauty appear more plainly identical than the teeth. The perfect shape and the clear tint of these "pearls of the mouth," as well as the rich color of their coral setting, the gums, are all indicative of vigor and vitality in their happy possessor. Furthermore, teeth form the clearest of demonstrations that the best diet for man is the simplest and most primitive. Savages who live on uncooked food, such as nuts and seeds, which require cracking and crushing, are noted for having fine, sound teeth, whose condition is plainly due to their vigorous exercise. If civilized man had retained this diet there would be no demand for toothbrushes and dentrifrices, and dentistry would be the least remunerative of professions.

However, since but few people relatively have had the will power to revert to this natural diet of uncooked food, and the eating of prepared food such as meats and mushes prevails, affording little exercise for the teeth, and many opportunities for decay, toothbrushes, and tooth powders, and the service of the dentist are necessary, and advice upon these matters is profitable and even imperative.

There is abundant reason for an effort to awaken a general interest in the prevention and arrest of the process of decay in human teeth. That there has been a progressive deterioration in the quality of the dental outfit of mankind through successive generations is claimed by many observing practitioners of dentistry. Yet the value of a good set of teeth can hardly be overestimated. Not only are they beautifiers of the face, but their service, in keeping the body in a healthful condition, is one of great importance. If the teeth are defective, food is improperly masticated, the result being that disorders of the digestion, and other pathological states, soon arrive.

The number, the position and general structure of the teeth is probably too well known to need recapitulation, and can be found in any textbook on physiology. So long as the covering enamel of the teeth is sound, the teeth, other things being equal, will not decay; but once this protecting wall is ruptured, or the teeth are attacked from within by defective nutrition, they will deteriorate, and a visit to the dentist's will soon be a matter of necessity.

The eruption of the teeth is a natural process, which, under conditions in every way favorable, may take place with little or no disturbance or discomfort to the child. Contrary to common belief, the gum is not actually *cut* by the tooth, but is absorbed from above it, as the tooth is pushed forward from beneath, the gum at this period being soft and pliable. Many physicians cut the gum above the tooth in the shape of a cross, hoping thereby to facilitate the appearance of the tooth, but it has been found that this actually retards and renders *more* difficult the appearance of the tooth, instead of facilitating it, as was thought! The tissue that is formed across the scar is more tough than the flesh, the result being that it is more difficult for the tooth to push its way through and make its final appearance.

If proper care be taken of the health of children, the temporary teeth should never suffer decay, and there should be no difficulty in their replacement by the permanent teeth. As the permanent teeth approach their full development, a process of absorption is set up, by which the roots of the temporary set are gradually removed. Little by little the roots are dissolved and the particles composing them are carried away, until only the crown remains. This absorptive process does not begin upon the roots of all the temporary teeth at once, but in the order corresponding to their development and eruption. Deprived of their support in the sockets and retaining only a slight adjustment to the gums, the crowns are pushed out by the movement of the tongue, cheeks, or lips during mastication, or are picked out with the fingers.

Nutrition is the process by which the various tissues of the body are nourished. The source of nutrition is the blood, essential to the life of every portion of the body. The teeth are no exception to this rule, depending for their vitality on the blood. One of the large vessels which supply the external parts of the head give off branches, which are called the dental arteries. From these smaller branches are given off, which pass through openings at the bottom of the sockets, and then through the hairlike aperture (the foramen) at the extremity of each root, through the canals of the roots, and into the cavity in the center of each tooth.

This question of the nutrition of the teeth is neglected far too much by dentists as well as laymen. It must be remembered that the quantity and quality of food eaten invariably affects the character and structure of the teeth, as they do any other portion of the body.

It has been found by repeated experiment that the simpler the food, the greater the care that is taken in diet, the harder and the more lasting will the teeth be.

The causes of decay in teeth are, generally speaking, twofold: (1) through defective nutrition from within, and (2) from chemical and bacterial action from without. The former of these two causes we have already mentioned, and need here but reemphasize its great importance. As to external causes, decay is chiefly due to various forms of chemical and bacterial action which may follow the use of improper foods and strong medicines; also the use of tooth powders and other washes of improper character. Decay has been caused by vitiation of the secretions of the mouth, either from a general derangement, or from a local cause, such as mumps, sore throat, etc. Doubtless the greatest cause of all, however, is the decay of food in and about the teeth. It is well known that, in fermentation and decomposition of animal and vegetable substances, acids are generated. The effect of an acid upon a substance largely composed of lime, such as the teeth, may be seen by the immersion of an egg in vinegar. In a few days the egg will be deprived of its shell. This exemplifies the manner in which the acid generated by fermentation of food, mixed with the secretion of the mouth, attacks, disintegrates and dissolves the lime of the teeth. Decay rarely or never begins upon the smooth surfaces of the teeth—those which are exposed to the friction of mastication—but always commences at points which, owing to their structure, or to their arrangement, furnish convenient receptacles for decay-producing agents. The crevices between the teeth form just such receptacles. Once the enamel has been dissolved at a certain point, decay proceeds at a rapid rate, due to the fact that the food substances are held in closer contact with the substance of the tooth, and not, as might be imagined, because the dentine is more susceptible to their action than the enamel.

It is a mistaken notion that sugars and sweetstuffs are excessively harmful to the teeth. Dr. George Black, in his excellent work entitled, *The Mouth and the Teeth* (p. 116), makes the following statements on this subject:

"Sugar and confections exercise no directly injurious effects upon the teeth, but when taken in excess do produce an acid condition of the stomach unfavorable to the health of the mouth; and, when left in the interstices of the teeth, rapidly undergo an acid fermentation resulting in a product capable of acting very injuriously upon

tooth structure. Particles of candy remaining between the teeth will, in a single night, produce demonstrable mischief."

Regarding this last statement it may be said that *any* substance remaining in the teeth overnight will produce mischief, and particularly is this the case with any animal compound, such as meat. Shreds of meat remaining between the teeth decompose very rapidly, as would be the case were they placed in any moist, warm locality. In order to keep the teeth in good condition, they should be cleaned at least twice a day, morning and evening and, if possible, after every meal.

It is commonly known that acids, particularly, affect the teeth deleteriously and because of that fact, dentists will frequently admonish their patients not to eat fruits of the acid variety. This, however, is a fallacy; for although the mineral acids, or the acids resulting from decomposition, will destroy the enamel and cause decay of the teeth, the natural acid of fruits (such as the citric acid of the lemon, etc.), will have no injurious effect upon the enamel; and, in fact, the eating of an apple the last thing at night has the effect of cleansing and purifying the gums and teeth and seems to possess a germicidal property altogether beneficial.

The accumulation of tartar may only be prevented by thorough cleanliness, and the constant use of a reliable powder or mouth wash. Hydrogen peroxide is an excellent antiseptic wash, in the proportion of one part of the preparation to three parts of water. Dentists will remove tartar, but it must be remembered that unless the *causes of its accumulation* are removed, it will continue to accumulate. Only by removal of the cause can tartar be permanently eradicated.

Too much scouring of the teeth is as injurious as too little. Many sets of teeth have been ruined by too much, or injurious brushing of them. Skill and not force, faithfulness and not muscle, are required to secure the best results. The brush should be moderately soft, the bristles long and elastic and of uneven length so as to facilitate their introduction between the teeth. Once a day is often enough to use a dentifrice, preferably just before retiring, plain water being sufficient for the other cleansings. Lime water, as a mouth wash, can be recommended in full strength, or more or less diluted, where the secretions are fetid or where the animal constituents are in excess of the earthy in the composition of the teeth, or where there is special sensitiveness either of the dentine or of denuded roots.

Previously to brushing the teeth, dental floss should be used to

remove any particles of food that may have lodged between them beyond the reach of the brush bristles. This thread should be drawn slowly and firmly between every two teeth.

Brushing the teeth should always be done with a rotary, and up and down motion, instead of straight side to side.

It should be borne in mind that in cleansing the teeth, one should avoid the use of water which is either too hot or too cold. Such extremes of temperature are certain to have a deleterious effect upon the dental apparatus. It will be found that water used when cold will not prove as effective in cleansing the mouth as when used at a higher temperature. In many instances, particularly on arising, it will be found advisable first to rinse the mouth thoroughly with water of about the same temperature as the body, and to rinse it further several times with water of gradually increasing heat. Afterward it is well to rinse the mouth with water made gradually cooler, until moderately cold water can be used without shock. Hot water will be found a particularly efficient means of cleansing the mouth if a small amount of ordinary table salt is dissolved in it, and the subsequent use of cold water will be found an excellent means of invigorating the gums and the tissues of the mouth.

The plainest mouth-washes and similar preparations are the safest to use.

Tooth Powders and Toothpastes.—There are a number of these on the market, of varying worth. In order to keep the mouth and gums clean, a brush and pure water supply the chief needs. To prevent the accumulation of tartar, etc., some antiseptic powder or paste is necessary. It may be said, however, that the plentiful use of fresh fruit, unsweetened, will go far in keeping the teeth clean and the mouth wholesome.

Of course the condition of the teeth depends, very largely, upon the kind of food eaten. In the first place, if one eats meat, the shreds and fine fibers are apt to become lodged between them and decay, causing no end of harm, through bacterial action. Mineral acids are thus formed, which eat away the hard enamel. Fruits rarely or never cause this deterioration of the teeth. Again, the internal nutrition of the teeth is an important factor, and the food must contain the necessary lime-salts, etc., for their preservation. If care be exercised as to the quantity and quality of the diet, there need rarely be any trouble caused by decayed teeth.

The use of a mouth wash is to be advised because of its antiseptic

qualities. A delightful mouth wash is made by adding a few drops of tincture of myrrh to a tumbler of water.

Where the gums need hardening, tincture of myrrh will be found most effective, and a good compound for cases where the gums are spongy and sore and recede from the teeth is made of one-quarter of a dram of tannin, one fluid dram of tincture of tolu, one ounce of spirit of horseradish and three fluid drams of tincture of myrrh. As for tartar—that enemy, consisting of salivary mucus, animal matter, and phosphate of lime—which encrusts the teeth, the first and most important step is to prevent it from accumulating by careful brushing of the teeth. If there is a considerable accumulation, due to neglect, it is not wise to attempt to remove it without assistance, as there is always the danger of an unskilled hand injuring the enamel. Failure to remove it, however, will result in the teeth becoming loosened and often inflamed, and the unsightly red gums frequently seen can be traced to it.

A great many people use powdered pumice stone to remove tartar from the teeth, but this should be done at very rare intervals—never oftener than once in five or six weeks. It is best applied by means of an orange-wood stick, the end of which is dipped into the powdered pumice stone and the teeth rubbed with it. The mouth must be well rinsed afterward to remove all traces of it.

Medicines are responsible for discolored teeth as most people can testify. Those most harmful are iron and mineral acid preparations. If medicines of that nature have to be resorted to, they should be diluted and taken through a glass tube.

The deteriorating effect of a decayed tooth upon the general health is sufficiently serious to bear dwelling upon here. The presence of a decayed tooth in the mouth endangers the sound teeth contiguous to it, besides impairing the digestion and is often the cause of that most distressing complaint—offensive breath. Teeth in such condition should receive immediate professional attention, so that they can be either filled or removed. When decay seizes upon a tooth it works so insidiously that its rapid destruction is almost inevitable, and, therefore, at least two visits yearly should be paid to a reliable dentist if only for the purpose of examination.

Keeping the teeth in good repair is necessary not only for their own sake, but for that of the entire physical system. In order that the entire physical economy may bear its share of the work of sustaining the body, it is essential that the preliminary steps to digestion

be properly performed, and this cannot be accomplished unless the teeth are sound and whole.

Dancing and Physical Grace.—The universal appeal of the art of dancing comes from the fact that the living body itself is the material of the art. Perfect muscular control is the basis of the dancer's art, and is chiefly marked by the untrained observer as a sense of agility and lightness. There is another essential to the perfect beauty of the dance that is closely interwoven with the sense of graceful activity.

The grace attained by dancing is an important element of personality. It is a most beneficial exercise, averting fat and keeping the body supple. It makes the blood course through the veins, and keeps one mentally alert, which gives one an entirely different viewpoint of life. Dancing has locked many a medicine closet.

If we would but take the time to look at those who follow dancing as a profession, either as teacher of dancing or on the stage, we would find that none of them look within ten years of their real age. Talk to a dancer or teacher and see how full of vitality her voice is. See how many things she is interested in. Notice her splendid muscles, erect carriage, straight back, well poised head, graceful arms and expressive hands. Compare her, though mature, with younger girls marred by drug store complexions and disinclination for activity.

Dancing in Class Drills.—Many physical culture instructors and class leaders have found that athletic dances and rhythmic exercises provide a most useful means of lending variety to class drills. Movements have been developed by some of these specialists that have proved effective in not merely promoting muscular coordination on the part of their pupils, but in bringing into play groups of muscles that usually remain unused in ordinary forms of calisthenic work.

Class instruction, however, is by no means the only method of acquiring knowledge and attaining the full benefits that attend dancing as an exercise. Instrumental music, and the maintenance of cadence by a skilled class leader, are, to be sure, most helpful. But the music of the class drill may be replaced by that of a phonograph or automatic piano in the instance of the individual, or even by songs with rhythm suited to the dancing exercises, or by intoning the spoken count in such a manner as to insure cadence.

Dancing for Physical Improvement.—It is true that dancing promotes activity and control of the muscles to a more decided degree than it develops strength. Yet it is equally true that because of the

absorption of the individual engaged in dancing exercises, it sustains the interest and insures more vigorous and even longer periods of exercise than is otherwise agreeable or earnestly enjoyable to many persons, and as a consequence, it is an endurance builder of value aside from its results in making the body flexible and responsive, and developing symmetry, poise and reserve strength as well as grace and symmetry.

In general it may be said that the most useful forms of dancing for the purpose of exercise are those involving more or less stretching of the body, in conjunction with movements of the limbs. There is a greater or less degree of exertion involved in all movements that call for balancing of the body, but when these are combined with stretching and turning the body, the effectiveness of such movements increases many-fold. For this and other reasons, chief among them their simplicity and ease of attainment, the folk dances of European countries that have been handed down from generation to generation are of the widest application for class drills and individual practice.

Such folk-dances are as well suited to the mature, in class and individual performance, as to the child. Indeed, modifications of them are in use in great numbers of gymnastic classes for business men and others today. Those to whom less restricted forms of dancing for physical development may appeal will find ample field for practice in the Russian and Greek dances, for which detailed instruction is given in textbooks on the subject.

The Voice and Personality.—Some among us, very fortunately gifted by Nature with great vitality, pleasing features and agreeable voices, need do very little except to maintain good health and physical vigor in order to retain these charms. With the rest of us, it is often necessary to adopt special measures for bringing about needed improvement in these matters, and it is just as possible for every man and woman to build up and enjoy a beautiful voice as to develop a beautiful, vigorous body. Indeed, need of the latter as one of the prime conditions of the former is one of the most important points on vocal culture which we wish to point out here.

This fact, that a pure-toned, rich and resonant quality of voice depends fundamentally upon a robust development and condition of body, is especially to be emphasized here, because it is so generally neglected elsewhere. It is a matter of universal observation that great singers of both sexes are universally men and women of robust physique and at least normal physical vigor. Perhaps in most cases

this is not solely and simply the result of special training along physical culture lines but is due to having been born with a powerful constitution.

It is not essential for purposes of vocal culture that one develop external muscular bulk, but he is not likely to have the lung power and the desired chest development if he does not have at least a normal and vigorous body throughout. And just as the weakling must develop and round out his entire body before he can hope for anything like a living voice, so the possessor of an ordinarily good singing voice may greatly improve its tone, timbre and power by general methods of physical development. One would not expect good tone from a violin, the body of which is defective, no matter how well veised in musical technique the player might be. We should expect the instrument to be as perfect in every way as possible. In the case of the human voice, the instrument by which it is produced should be as perfect as possible, and physical culture is therefore an indispensable factor in vocal culture.

In speaking here of the importance of a good chest development, it must not be understood that chest breathing is referred to, for that would be fatal to good singing. A full chest development is necessary not only to provide plenty of room for the lungs, so that there may be an ample supply of the residue air even after exhalation, but especially because of the function of the sternum or breastbone in giving resonance to the voice. It acts somewhat like the sounding board of the piano or a violin, and that is why good singers always have good chests. It does not matter how much force is used, for nothing but a weak voice can be produced with a sunken chest, whereas the tones will be strong and vigorous, and without effort, if the chest is full and robust.

Diet is also a most important factor in vocal culture for the very reason that, as already stated, the condition of the body and of the health has everything to do with good voice production. The vocal cords and the air passages concerned must be free from irritation and catarrhal disorders, and errors of diet have so much to do with such conditions.

It may be said in a geneal way that diet applies to voice culture as it applies to athletics, namely, that what is best for the general health and the body as a whole is also best for the specific purpose in mind. There is no special food that is of exceptional value for the voice, except as it may be of exceptional value for the all-round nutri-

tion of the body and for producing a pure and wholesome quality of blood.

At the very outset the first thing you must learn is that a clean system and a clear voice are not so much the effects of what you eat and drink as they are the happy consequences of your having *left out* of your diet those things which Nature does not want. In short, your aim must be to learn what, how and when *not* to eat—the search for "something to clear the voice" should be superseded by a careful, thorough, self-denying elimination of those foods and drinks that clog the system and, consequently, the voice. And you will find that, after the eliminative process has been carried to its proper end, your diet will consist of just enough of good, pure food to rebuild the everyday wear and tear of functional processes and mental and physical activities; and such an amount will seem, in comparison with what you are now eating, ridiculously little.

Colds affect the voice primarily at the throat; acutely as hoarseness, chronically as laryngitis. Pharyngitis (chronic sore throat) does not directly affect the voice, but may do so indirectly through inflammation of the soft palate, uvula and fauces, thus decreasing the size of the pharynx, which is a resonating chamber. Voices are most affected by hoarseness in the lower or chest registers. Thus bassos and contraltos are more completely disabled by it than are the higher voices. Be the hoarseness ever so severe the upper mixed tones and the head tones are not seriously impaired by it. If the cold be "in the nose" the nasal resonance is clouded or dead, and the tenor cannot "appear"; if "in the head" the soprano has lost her best tones and the brilliancy of her entire voice and must disappoint her audience.

Nature, if permitted, will, in an incredibly short time, remove your "cold," cure your hoarseness and restore your voice to its normal efficiency. If you continue without a halt the same habits which made the "cold" a necessary move of Nature the conditions become chronic and you have catarrh or laryngitis. If you continually take in superfluous or poisonous matter, Nature must, in order to save you, continually throw it off—you *must* have catarrh. Neither drugs, nasal douches nor inhaled medicated fumes will cure it. The mouth proper, having no excretory membrane, shows no inflammation during colds and catarrhal conditions, and those singers who have been taught to force every tone to resonate "in the mouth" are least liable to disability from colds. Treatment for colds and catarrhal conditions will be found in other parts of this work.

In speaking of the physical requirements of the voice, and its relation to the condition of the body, it may be said that a condition of warmth of the entire body is always favorable to good intonations. Perhaps in saying warmth we should have said an active circulation. But this is associated with the natural warmth of the body. If chilled, or still shivering from previous exposure, it will be impossible for you to sing or to speak and do justice to your voice, for it simply will not respond. Under such circumstances, if compelled to speak or sing in public, radical means of regaining the vigorous warmth of the body should be adopted, so that the circulation in the air passages will be active and the voice clear.

The production of voice is accomplished by a truly wonderful mechanism. As everyone knows, voice is produced primarily by the vibration of the "vocal cords," consisting of a pair of lips stretched across the air passage into the lungs, these lips being open in ordinary breathing, but being caused to vibrate by the escaping breath when drawn more closely together. These vocal cords, however, can accomplish little without the other parts of the instrument, including the breathing apparatus and the resonance chambers of the larynx, pharynx, mouth and the nasal cavity, which may be known more advantageously as the naso-pharynx. This initial sound produced by the vibration of the vocal cords is a very faint one, but because of the fact that it is reenforced and multiplied by the resonance of these air chambers it emerges with the full sound of the voice as we know it. It is as in the case of the violin, in which the vibration of the strings themselves does not generate much sound, but in which the reenforcement of the sound by the air of the box, set in vibration by the vibration of the string, produces a round full tone that will fill a large building. It is also like the case of the trombone or other brass instrument, in which the sound is multiplied by the megaphone character of the end of the instrument.

The larynx is a cartilaginous cavity forming the upper part of the trachea, or windpipe, and it is in this that the vocal cords are situated, stretching across forward and back just under the epiglottis. There are nine cartilages in the larynx, three single (the thyroid, cricoid and epiglottis), and three pairs (two arytenoids, two cornicula laryngii, two cuneiforms). These are all connected by ligaments and moved and controlled by a host of small muscles. The interior of the larynx is lined with mucous membrane. The thyroid is the largest of these cartilages, consisting of two alae, each of which forms a side of the

larynx, and when joined together these form a triangle; the apex is familiar to everyone under the name of the "Adam's apple." The cricoid cartilage, located just beneath the box formed by the thyroid, is not unlike a signet ring, with the important part, that representing the signet, behind. The "arytenoids" (the Greek for pitcher), are so named because they resemble the mouth of a pitcher when brought together. They are small triangular bodies placed on top of the cricoid, in the upper part of the signet portion of the latter, and are important because they are movable and because the vocal cords are attached to them.

The larynx is the origin of the voice in all cases, and such terms as "head-voice" and "chest-voice" are somewhat misleading, for the vibration in all cases is generated by the breath acting upon the vocal cords. The so-called registers of the voice refer to tones of a like quality produced by the same adjustment of the vocal cords, and they should really be given names which describe them more accurately than "head" or "chest" voices, etc. The so-called "chest-voice" is produced by the vibration of the full length of the vocal cords, reenforced largely by vibration of the air in the cavity of the chest, while the "head-voice" or falsetto is produced by the vibration of only a part of the vocal cords, these being so forced together at their posterior ends as to permit only the open portions of the forward ends to come into play, the sound being reenforced by the resonance of the upper cavities, or in other words, the mouth and bony cavities of the skull. Those who think they "feel" their head notes coming from the forehead, or the back of the nose, are mistaken, for they all originate in the larynx.

Briefly, then, the power which produces the voice is the breathing apparatus, particularly the diaphragm, the vibration is generated in the larynx by the vocal cords, and the quality of tone after this depends upon the expansion and resonance of the upper air chambers, upon the manner in which the tone is directed past the teeth and lips, and to a certain extent upon the chest and its formation, as already said. The first, and all-important factor, however, is the power and its control. Without this breath control, and absolute freedom in breathing, good voice production is impossible. The various breathing exercises which the physical culturist has been accustomed to will therefore be of great value in this connection, and if one has not yet made a practice of such breathing exercises, then we should refer him to the special exercises of this kind illustrated elsewhere in this work. But in taking such preparatory breathing exercises, the student should place his hands not

only upon the stomach, in front of the waist, to see that it expands properly with inhalation, but in turns also upon his sides and also upon his back, to see that the expansion of the body extends to the sides and also backward in each inhalation. For only under such complete expansion of the body backward, sideways and forward, at the waist line, is the diaphragm acting correctly. This is essential to good singing and the breath control that it depends upon. And what applies to singing also applies to the correct formation of voice in speaking.

In addition to the ordinary breathing exercises for breath control, it is well to practice a special exercise for refilling the lungs in the momentary pauses permitted when singing or speaking. Under such circumstances, there is no time for the long inhalation through the nose. It must be through the lips, and is accomplished by a quick "gasping-like" action of the diaphragm. Having exhaled completely, fill the lungs almost in an instant with a gasp, expanding the body at the waist line only. The lungs will not be entirely filled, for this is not desirable for the best vocalization, but the deeper parts of the lungs will be supplied with air in this way. This should be practiced assiduously, until you can do this without any suggestion of strain or effort, and you will then never get out of breath either in speaking or singing.

Remember that it is not force that makes a voice powerful, but control of the breath. Violent expulsion of the breath cannot accomplish any good in giving volume to the voice, and can only strain the vocal cords. In all things connected with the voice, there must be no strain of any kind. It is often said that it is hard to sing, but this is not because there is any physical effort or exertion required. It is rather because of the mental difficulty of control, or the difficulty of restraining the tendency to exertion or strain. Everything must be natural and easy, the only place where there may be any stress at all being at the waist, in the action of the diaphragm. But even this should not be appreciable when the muscles concerned are properly developed and strengthened.

In order to acquire the general relaxation of the body, or as we would better say, the freedom from tension necessary for perfect tone production, it is well to commence the practice of breathing exercises and some vocal exercises by lying flat on the back. In doing so one hand may be placed over the stomach to assure yourself that you are breathing properly. After you can do these exercises, and especially

the first vocal exercises upon the back without tension, then you may practice them in the standing position.

The position of the body is a most important one, and it scarcely needs to be said that an erect carriage of the body is the essential thing, though without strain. There must be no stiffness or tension. For this reason the position of feet together is not recommended, but rather a position with one foot a little in advance, the weight resting upon the forward foot, preferably upon the ball of the forward foot. In leaning forward, the swaying should be done from the ankles. The chest should be well up and forward, the abdomen consequently restrained, but all this without strain or tenseness, so that the muscles about the waist may act freely. It is perhaps unnecessary to say anything here about the matter of dress or the use of the corset in women. It is obvious that any constriction about the waist, of any kind, must interfere seriously with the production of the voice. This proper position of the body is necessary for two reasons, namely, that the chest may be in a position to aid in the most perfect resonance of the voice and also that the breath may be properly controlled. Even in the expression of tones of great volume, very little breath is required.

Having the physical foundation and health necessary for a good voice, having the proper position and the breath control, there remains the important matter of the placing of the voice, upon which the quality of the tone depends. This is a matter about which there has been much difference of opinion among experts, and about which entire books have been written in technical jargon. The importance of the question is indisputable, however, for everyone knows that many beautiful voices have been ruined by methods taught by the most high-priced teachers.

The complete relaxation of the throat and throat muscles is the one first and greatest essential of the perfect tone. Above all things, let there be no squeezing of the throat. Rigid muscles here are the cause of harsh tones in both speaking and singing. As we have said, the sound and the pitch originate in the larynx through the vibration of the vocal cords, but the timbre and quality of voice is determined chiefly by the resonance of the hollow spaces above. If these hollow spaces are unchanged, the tone will be natural, but any contraction of the muscles of these parts, and especially of those of the throat, will cause some of these spaces to close up more or less, and others to change their form, so that the tone will be anything but pleasing. These spaces must be kept open, and the first principle of good vocali-

zation is to avoid making hard work of it, to avoid any exertion of any of the throat muscles, but on the contrary to keep them absolutely relaxed. *The pure tone is the tone that is made without effort.* It is in this respect that a great many vocal teachers and pupils go wrong. By placing the thumb and fingers upon the throat very gently, feeling the "Adam's apple" and adjacent parts, this muscular contraction and also the movement of the thyroid cartilage can be sensed very plainly.

To make sure of the complete relaxation of all of these muscles, and thereby insuring the open and unchanged condition of the resonance chambers, the student should at first practice most singing exercises with thumb and fingers on the throat. To secure this relaxation most completely, it will help to relax all of the features of the face as well, letting the jaw drop loosely and assuming as much of a drowsy expression as may be necessary for the most absolute freedom from tenseness of all parts. In this position, sing a soft tone, without consonants—just a mere vocalization. There will be vibration, but there should be no rising of the cartilage, no tightness or contraction of the muscles. It may help you in this if you will remember that there should be no rising of the back of the tongue in the mouth, such as takes place in swallowing. After you can get this relaxation while singing simple vowel sounds, then you can proceed with other singing exercises. It is a mistake for anyone to try to sing songs without such preparation as is necessary to master the essentials of perfect tone production, and without a thorough course in such exercises as are offered here, together with plenty of practice in scales.

For helping to acquire this relaxation of the throat and also for developing resonance of the upper chambers, humming is an ideal exercise and should be much practiced every day. This should be started very softly, without any constriction of the throat, and gradually allowed to become a little louder. Practice humming in various keys. A very good exercise for the purpose is to imitate the sighing of the wind, with various flucuations of pitch, since this is exceedingly effective for developing the resonance of the naso-pharynx. Practice other humming exercises with mouth closed and with it open. Say the syllable, "ing," a humming noise that should come out of the nose on the breath, which may be felt slightly by the fingers placed under the nostrils. Place the thumb and forefinger upon the bridge of the nose in this exercise so that you can feel the vibration in the nasal chambers and be sure of executing it correctly.

To avoid throatiness one should avoid the feeling that he is singing

in his throat. The ideal tone is that which proceeds unimpeded through the open spaces of the larynx and mouth and is directed forward against the hard palate in the upper forward part of the mouth, or, as one might say, toward the upper teeth. One should think of this in singing his exercises until he has so thoroughly established this forward placing of the voice that he will continue it naturally and without further conscious thought. One of the most perfect of all exercises for attaining this forward placing is the practice of singing the word "Noon." This will naturally bring the voice forward as desired. It should then be varied by singing, "nan," "neen," "nahn," etc.

No attempt at the use of consonants should be made until after one has mastered the singing of pure vowel sounds, and these should be sung with mouth open freely, but without the strain that comes from forcibly opening the mouth too wide. The broad "a" (ah) sound will require the mouth well open. Instead of practicing the pure vowels without consonants, however, it will usually help in the proper forward placing of the voice to use the consonant "l," and always making sure that there is no constriction of the throat or tightening of the muscles there. It must not be hard work, except in the way of mental application, and the less mental stress the better for the bodily control. It is best in the beginning to practice only a few minutes at a time, and perhaps several times each day. Sing on the various notes of the scale, accompanied with chords on the piano, if convenient, "La," "Lay," "Lee," "Lo," "Loo." It will also be well to vary this by changing the vowel sound all in the same tone, as "La-a-ee-o-oo." Following this may come other singing exercises of the same character, as taught by instructors of the Italian method, or similar methods, together with scales, etc. Up to this point, however, the suggestions given here are just as valuable for those studying to improve the voice for purposes of elocution, public speaking or pleasing conversation.

There is one exercise that is especially to be recommended both for breath control and for assurance in regard to the necessary ease of tone production. That is the practice of sustaining a tone on one breath for some time, and can advantageously be practiced in conjunction with a piano. Time yourself with a watch, take a fairly good breath, but not a forced one, strike a chord and sing the tone, "Ah," or any other vowel desired, or varying the vowel if preferred. The tone may also be varied in volume, for both loud and soft tones should be made

with the greatest economy of breath, or, in other words, with the strictest breath control, holding it as long as comfort will permit, and then, after two or three intervening breaths, repeating the exercise on the next note up the scale. In this you should sustain each note from twenty to forty seconds, though it is not unlikely that before long you may sustain each note for more than one minute on the same breath. You may then be sure of breath control and of ease in vocalization, and the voice will roll out in all its fulness and resonance.

The Speaking Voice.—To improve the speaking voice the two most important factors, as in singing, are the control of the breath and the development of resonance. Anyone who has gone through the exercises previously described has already gone a long way in this direction. But there are some very simple ways of improving the speaking voice in these respects. In learning to speak well, the following exercise may be suggested in addition to those already mentioned.

Drop the body forward, relaxed from the waist, exhaling as you drop, and keeping the knees rigid. Now begin to breathe in the air in short inhalations through the nose, letting the body rise almost automatically while the lungs fill until they have been expanded to their full capacity. After taking the last possible breath with the nose, it will be found that it is still possible to sip in another breath or two through the lips. Now begin to speak slowly and carefully, in a clear, rounded tone, some verse, such as Stevenson's lines:

> This be the verse you grave for me:
> Here he lies where he longed to be;
> Home is the sailor, home from sea,
>   And the hunter home from the hill.

Any poem of good rhythm, with several resonant words in it, will do. Say it once, twice, or three times on the breath you have in your lungs until it entirely gives out, taking care to bring out the full musical effect of the words.

As you practice this exercise again and again, with any poem or piece of highly resonant and rhythmical writing you wish to repeat, you will find that you can say more and more without taking a new breath, and can learn so to control your store of breath as to create the most attractive tones.

After you have attained some proficiency in this, start as before

by hanging limp from the waist and filling your lungs completely with air, and then proceed to read aloud as well as you can, straight ahead through some good piece of writing. But this time do not allow the reserve of air in your chest to give out. Keep replenishing it, wherever you find opportunity, in the pauses between phrases, with sips of air through the mouth. This may seem difficult and awkward at first, but with practice one learns how to keep on reading or talking while keeping the lungs supplied with a reserve of air, and can improve the control of the voice and all the voice tones.

Resonance, which is the second great necessity in cultivating a good speaking voice, may be improved by saying over and over the following series of words; striving for a full, round, mellow tone: *Boom, doom, gloom, loom, room.—Gong, wrong, song, long.—Dome, home, foam, Rome.—Bun, fun, run, sun, done.—Clang, bang, hang, rang, swang.*

For the cultivation of resonance in connection with the pronunciation of vowels, one exercise is to say over and over, watching one's voice production carefully, the words, *O Maria, come over the mountain.*

American voices suffer from two special difficulties. In the first place, people tend to speak on a monotonous level. Everyone who desires an attractive voice should cultivate varieties of pitch and tone, and learn to make the tones attractive at any pitch. It is a good practice to take any common word of one syllable, like *go,* and endeavor to speak it at each level of the scale, going up and down the scale with the speaking voice instead of the singing voice. Of course, the possible range is not nearly so great as in singing. In reading endeavor to color the tone, and to change the pitch, observing the different emotional causes and effects of differences in tone and pitch. It will be observed at once that emotion of any sort intensifies the voice; that an endeavor to conceal the feelings and speak in a tone of superficial politeness means a higher and lighter tone altogether. By observing a good actor or actress on the stage all the different possibilities of the human voice in expressing personality may be learned.

The second defect in American voices is the failure to make adequate use of the lips. The lips are tightly drawn, and the mouth barely open. One teacher of voice culture always starts the lesson by having the pupil yawn several times. Yawning stretches and relaxes the throat and the lips. Various exercises may be practiced to encour-

age clear enunciation and the proper use of the lips. One exercise that also improves the use of the consonant *r,* which is the hardest single consonant for most people to enunciate, is as follows:

Say ten times in succession, the following: *Around the rough and rugged rock the ragged rascal ran.*

Another series of words which gives the lips exercise is: *Proper, potatoes, prunes and prisms.*

Almost all the favorite tongue-twister combinations of words in which children delight, like the classic one about Peter Piper and the peppers, are good practice. But mainly it is necessary to become conscious of this tight-lipped way of speaking, and to learn to use the lips more freely. This greatly improves the general contour and the pleasing charm of the lips themselves.

To master these vocal gymnastics, nothing is more helpful than to listen to yourself read good literature aloud. Such reading exercises should be performed when you are alone and therefore not apt to be affected by self-consciousness. Shakespeare's plays, Byron's poems, the speeches of Lincoln, the descriptions of Dickens and of Scott, the conversations in the novels of John Galsworthy, all furnish excellent material for such practice.

It is well to practice the vowels combined with the various consonants such as: *la-le-li-lo-lu; mah-ma-me-mi-mo-mu; bah-ba-be-bi-bo-bu; kah-ka-ke-ki-ko-ku,* and so on, using both upward and downward inflection and emphasizing first one syllable and then another.

When reading and when speaking, endeavor to "color" your words with your thoughts. Paint a picture in sound.

Enunciation.—Clear enunciation should go hand in hand with the proper use of the voice. Otherwise voice quality and diction both suffer. It is important when speaking to pronounce properly the endings of words such as *ed, ful, ing, ment, ence, ness.* Be careful also not to clutter up your sentences with such useless, meaningless expressions as: *Listen; I see; of course; however; and so; et cetera; don't you know;* and others.

If you are inclined to stutter, apt to be at a loss for a word, *plan your conversation.* Before calling, deliberately sit down and think out what you intend to say. Many eccentricities in speech are caused by an overactive or by a clouded mind.

One of the most auspicious moments for impressing persons is the moment of greeting; therefore, be sure to cultivate a pleasant tone and manner of using such phrases as: *Good morning.—Thank you.—*

May I present?—Do you think so?—Good afternoon.—Good-by.—May I do anything for you?

Never fail to call persons by right names, even when it is necessary to halt the conversation to make sure you are pronouncing them correctly.

Constantly observe the effect of your voice on others. Take care not to talk too much and never neglect the courtesy of attentive, interested listening. Silence is often the better part of speech.

Unconsciously, people are swayed by the voice. Not always do they realize that they are being influenced by a voice alone, and less often that the voice sounds the keynote of personality.

To the health-seeker, the culture of the voice is more than a means of casting a spell over others; it brings a happy note of interest to his daily routine. For the deep breathing exercises essential in the cultivation of the voice are also fundamentals of health-building.

PART 13

THE ROLE OF SEX IN MARRIAGE

WHEN we study the processes that sustain life, we find that the nutrition and workings of the body may be quite definitely understood. Comparatively few mysteries remain to plague mankind in this respect.

The processes by which life is reproduced may be definitely understood also. From the beginning of his written history, evidence exists that these processes have been familiar to civilized man.

Those isolated and remote tribes that have failed to associate childbirth with sexual congress are notable exceptions to the rest of the world, and are of consequence for this reason alone.

In considering the relationship between marriage and health, we must go further than to survey the anatomy and physiology of the parts of the body that are involved. Such knowledge, important as it unquestionably is, should be supplemented by some grasp of the emotional and mental reactions involved to stimulate intelligent thought or action.

Sex-Life and Marriage.—Whatever changes may be in store for humankind, in our Western civilization or elsewhere, so far as sex relationships are concerned, marriage still is the form of sex union sanctioned by the State almost universally.

The self evident principle is accepted throughout the world that whatever the limitations or accomplishments of marriage may be, it affords both the child and its mother their greatest chance for security, provided the male parent is able to sustain the dependents thus created.

Health is an important matter in marriage, as the pages that follow maintain.

Health is an important factor in fatherhood and in motherhood, in particular.

Nothing is more essential for satisfactory parenthood than vitality and vigorous health. The weak, sickly, anemic and nervously deranged cannot expect to make good parents, no matter what excellent mental qualities they may possess, for their children will probably be more or less handicapped by weakness. Yet, even weaklings, by persistent practice, may build up health and strength, realizing in time a normal degree of healthy vigorous manhood and attractive, wholesome womanhood.

Every right minded person must realize at once that one owes it not only to one's self but to one's intended mate and possible progeny to perfect one's health as much as possible before contracting marriage. In a general way we may insist, as one of the first rules of marital selection, upon the choice of one who is thoroughly healthy and apparently sexually normal, or one who has no condition that will prevent the acquisition of such general and sexual health. In the latter instance—when the health is below normal but capable of being made normal—the building or rebuilding of health should be accomplished before marriage, unless there is a more rational and complete understanding of sex and eugenics than is possessed by the average man and woman who enter marriage.

We must not forget that there are some forms of disease and some conditions which, when contracted and fully established, are eradicated with difficulty. The more deep-seated any condition has been allowed to become the more earnestly and persistently will one need to adhere to a rebuilding and revitalizing program in order that the highest degree of health possible may be recovered or, in case such a degree of health has never been possessed, that measures are taken to insure it.

The indications of a vigorous healthy individual are known to most people, though many apparently disregard all lack of these indications when they select their life mate. And the indications of a well-sexed condition are those of normal vigorous health, for there are no special, mysterious and peculiar signs of normal sex vigor, as some would have us believe. When one finds a lifeless, colorless skin, the sparkless eye, the drooping shoulders, indolent carriage and slothful gait, the nervous irritability or nervous unresponsiveness, the weak voice, and other indications of reduced vitality, one usually finds constitutional weakness, low resistance to disease, and reduced mental ability, temporary at least. But there are also various gradations of sexual and general health and vitality, indicated by some one

or other of these signs, while in other respects the individual may give indications of comparative health.

True womanhood may be said to be generally denoted by a well-knit fully formed figure, a full-sized waist and obviously strong back with an erect carriage, a full throat, a well-rounded and firm, though medium size bust, the characteristic feminine outlines of broad hips and pelvis, not set too low, a light, elastic step, warm hands, a good complexion and a clear melodious voice. Naturally, however, much consideration must be given to the type of individual, and this is determined largely by heredity. Much can be learned of the health and prospective capacities for motherhood of any woman by a knowledge of her ancestry. Some of the above qualifications may be poorly marked, but some of them must be present.

And on the side of the man, we may say generally that virility is evidenced by a strong and robust frame, a normal muscular development, a strong neck and back, a high chest, broad, square shoulders, an erect, manly carriage, a clean strong physiognomy, warm hands, a direct steady gaze and a clear full voice. We might say that the general build or plan of the perfect masculine body is something akin to an inverted pyramid, or, as we might say, to the letter V, the apex represented by the feet, the hips narrow, and the greatest width at the shoulders. But here again it would be erroneous to look upon all men who are not built according to this plan as lacking in virility and the qualities of fatherhood. The type given is perhaps the ideal type, especially for beauty, but some men may have superb virility and general vigor who may vary considerably from such a physique.

In woman also there may be fairly wide deviations from a classical build, in which variations there will still be found all the essential physical qualities for marriage and motherhood, though it is generally conceded that as a general rule the figure should conform more nearly to a diamond-shaped outline or double pyramid, the feet and head representing the upper and lower apices, and the broadest portion by the width of the hips.

These geometrical forms are merely verbal illustrations. Hard and fast rules in applying them would be uncalled for. The truth is that the most marked degree of normality of physique, in this as in other respects, may not be conspicuous at first glance in the most attractive and eugenically promising of our younger generation. But the transition from everyday garments to the costume of the beach reveals

The male physique is marked normally by breadth of shoulder resembling an inverted pyramid.

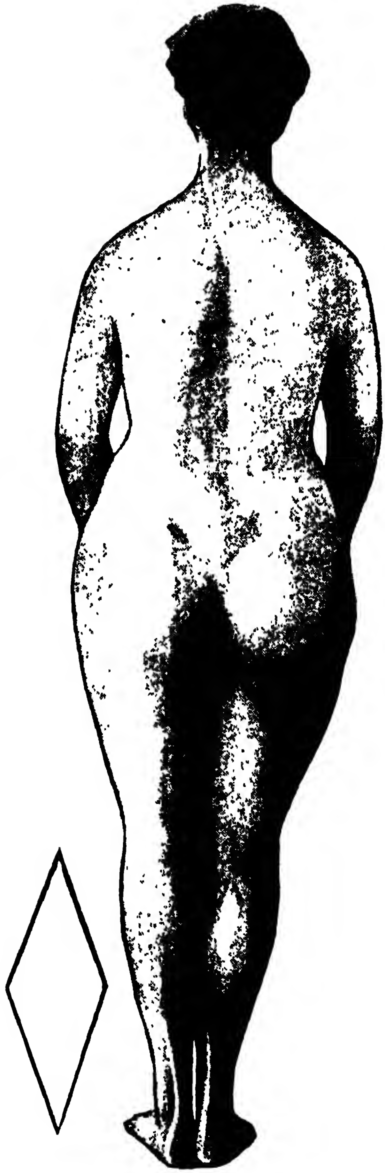
the presence of proportions of breast and hips and shoulders that might otherwise be overlooked, so the old rule cited still holds good.

Courtship and Love-Making.—The requirements of sexual hygiene, as well as of good breeding generally, require an avoidance of too much personal familiarity between those of the opposite sexes. Relationships among those of opposite sexes should be strictly of a social nature. It is perhaps only natural that the romantic but irresponsible boy should enjoy the pleasure of a "good-night kiss" at the front gate, after an evening spent together, but while it may be harmless enough in some instances, yet one kiss is likely to lead to another, and yet another, and still another. This intoxication of the senses is far more seductive and may be far more dangerous than that produced by any wine.

Self-restraint is one of the most vital and important principles of human conduct, the most necessary to a happy and successful life. In the first place, this freedom in the expression of amorous instincts may lead to moral disaster, as it so often has. But even if both parties are possessed of strong powers of self-control, the amative excitement aroused is woefully destructive to the nervous system and detrimental to the health generally.

The close, warm, personal embrace of a pair mutually attracted to each other in a physical way may lead one or the other to believe that it is love, or at least to say that it is love. If the girl is more or less passive, and as uninformed as most young women of the past have been, she may possibly fancy that these kisses, caresses, embraces are the manifestations of a very intense love which the young man holds for her. But the truth there is that these are often the manifestations of a physical attraction. Hundreds of thousands of trusting and confiding girls have gone to their ruin through ignorance of this fact, and there are still young persons who do not know this.

There are many who feel that an engagement gives one many privileges in the way of love-making, but the weakening effect or the other evil consequences are just the same in such a case as in any other. One would naturally not attempt to prescribe any set limits to the personal relations of engaged couples, but if they go too far the result will be a drain upon their nervous and sexual systems and a general derangement of health. In an engagement it should be regarded as an important necessity to avoid laying emphasis upon the physical relationship or the physical attraction, if only to make sure that the mental and other qualities are such as will make for a happy and



This drawing of the female form suggests maturity and not slender youth. The width of the pelvic region has been stressed to emphasize the resemblance to the outline of a diamond.

successful marriage. If one is blinded by the spell of a physical attraction, he or she may marry one who, in character, in mentality and in other respects, is not such as to warrant such a matrimonial choice in a more sober state of mind.

Love-making should never go beyond the limits set by a sincere respect for the person of the other. Young people should learn to regard their persons as sacred and private, demanding the respect of others. Life means so much in other directions, is so rich in clean and wholesome pleasures, so full of possibilities of every other kind, that one should above all avoid the premature awakening of the sex instinct, as well as undue emphasis upon its influence at any time. Let one possess vigorous sexuality in the highest possible degree, but let him also strive to go through life as nearly unconscious of it as possible.

Dancing.—The influence of dancing depends largely upon the attiture of the individual. Dancing of the ordinary kind is entirely unobjectionable, for it is so largely made up of the factors of music and rhythmic exercise, and the mental exaltation that go with them, that the element of personal contact becomes a negligible quantity, and the dance resolves itself into a purely social pleasure. Public dance-halls are to be condemned because they are haunted by those who place a vulgar interpretation upon every phase of life, and who would naturally degrade dancing and corrupt those with whom they dance. This applies more directly to places maintained to serve as meeting-points for men and women to whom the dance is in reality a secondary consideration. Such dance-halls quite often harbor evil conditions.

Perfect health and normal love instincts would bring us back to the pristine conditions of true "natural selection," which has accomplished the evolution and improvement of the race up to the present point, instead of the artificial occasions for matrimony which are now helping to hasten the growing degeneracy of ever larger and larger proportions of our population.

Normal and well-developed men and women have an instinctive power of "sensing" each other's sexual adaptation and responsiveness. It is this instinct or sense, which, if unhampered by false education or selfish interests, usually leads one to make the best available selection of a mate, being far more accurate and reliable in this respect than all the logical admonitions and preferences of friends or parents. Naturally, the girl or boy who has never had an opportunity of exercising this sense, through lack of association with the opposite sex of

the same age, may not be guided accurately or wisely in his or her selection, and for this reason free social contact is imperative, permitting the best possible development of this sex sense.

The attraction between two of opposite sex may in some instances be purely physical, simply growing out of admiration for corporeal qualities and without any mental affinity, or in some cases, the reverse might apply.

Health and Sexuality.—Health of the entire body is the very first essential to perfect sexuality, and the first requirement of sex hygiene is care of the body in order that one may have clean blood and the maximum of vitality. The love instinct is largely controlled by and dependent upon the general state of your physical health. Many of those who are struggling with marital difficulties will be able to solve their problems with little trouble as soon as they learn that the love instinct has a physical basis, that it is, indeed, the expression of the physical impulse that makes for parenthood. This fact is fundamental, and the more perfect and vigorous the health, or in other words, the more normal the entire organism, the more acute and perfect will be

Photo Underwood & Underwood, N. Y.

In minor as in more important matters of courtship and marriage, peoples far from civilization differ from European customs. These members of a trans-Pacific tribe taboo kissing, and instead rub noses as a love-making preliminary.

the sex instinct. In a general way it may be said that the condition of the sexual system is usually indicative of the general health, its power increasing or decreasing in vigor accordingly.

Modern civilized life is no more conducive to a normal sex instinct than to the most perfect degree of general health, for the artificial influences met with upon every hand are of a stimulating and exhausting nature. The nervous hustle and hurry of our cities, the noise, the strain of financial and business life, the unwholesome recreations, the late hours at night—all are inclined to upset the well-balanced life which in a state of nature we could easily maintain. Only he who understands his own nature and his needs can hope to be either physically sound or sexually normal in this strenuous, neurasthenic age.

For the sake of vigorous sexuality, accordingly, we may especially recommend healthful, outdoor exercise, early hours, plenty of sleep in fresh air, and all of the general conditions for building health and vitality expounded in other portions of this work. We need not do more than allude to them here, with special emphasis upon their destructive effects as far as sexual power is concerned.

Alcohol, drugs, narcotics, tea, coffee and the like act directly upon the nervous system and play havoc with sexual vigor. Remember that all of these things which affect the body as a whole in an unfavorable way are especially detrimental where the reproductive power is concerned. They are not only conducive to the individual harm which is so clearly apparent, and to marital unhappiness, but have even more serious consequences in depriving the offspring of that intense, primordial vitality which should be the birthright of every child.

Dress.—The matter of clothing is one which should have special attention, inasmuch as an excess of clothing, too heavy bed coverings, rooms that are too warm, and all other unnatural influences that tend to overheat the body are of a stimulating nature and sometimes conducive to sex excitement. Wear no more clothing at any time than absolutely necessary for bodily warmth and comfort.

Bathing.—Everyone should cultivate cool air and take air baths as often as possible. They have a splendid effect in toning up the nervous system and in quieting tendencies toward undue generative excitement. Aside from the demands of cleanliness, cold baths and especially cold sitz-baths are valuable in this particular respect, also acting powerfully as a means of building sexual vigor.

Lying in Bed.—One of the best habits to form early in life is that of getting up instantly upon the moment of awakening in the morning.

Get out of bed immediately and be busy about the affairs of the day, preferably starting with exercise and bath, unless the daily exercise is more advantageously scheduled for some later time of day. Similarly, it is unwise to go to bed until physically in a condition to profit by the rest and to fall asleep immediately. Heavy bed covering or an excess of it should be carefully avoided.

Diet is unquestionably an important factor in attaining a condition of normal and vigorous sexuality. The average diet is altogether too stimulating in character, and if we could get back to the simplicity and wholesomeness of the diet of pioneer life, it would be better for the entire world. Distorted, overstimulated sexual instincts, would diminish if the average food supply of each individual in the nation were reduced and restricted to edibles of a wholesome character.

Pepper, condiments, hot sauces, tea, coffee, alcoholic beverages, white flour and many other articles commonly found on the ordinary table should be avoided if one desires a life of high aims and refinement of character. Meat likewise has a stimulating tendency in this direction and is best used moderately, particularly if one is in a position where he must contend against abnormal desires or the force of injurious habits. At least, if one is unwilling to adopt the vegetarian diet in its entirety, he should restrict himself to a very small allowance of meat, which is all that could be desired anyway for the mere needs of bodily nutrition.

A satisfactory diet and other means of acquiring clean, pure blood and improving the general health, will increase vitality and nervous energy. It will at the same time avoid the stimulation and abnormal excitement of this passion which in the past and present has done and is doing so much harm in the lives of human beings everywhere. Instead of a weakened, nervous system, and an uncontrollable sexual impulse, which may be regarded as not altogether unlike the symptoms of hysteria or other nervous derangement, we shall, with the physical culture life, acquire a sound and steady condition of nerves and a far stronger sex power which is well-ordered and under control.

Constipation is one thing that should always be remembered in considering the matter of sexual hygiene, for though apparently not directly related, this condition indirectly has a tremendous influence in falsely stimulating or exciting the generative system, always, of course, with an ultimately weakening effect. Constipation not only tends to poison the system and cause derangement in that way, but acts directly by pressure upon the adjacent parts of the generative system, in women upon practically all parts, in men upon the pros-

tate gland, causing an irritation which is readily mistaken for the natural expression of a normal passion.

For very similar reasons it is important to see that the bladder is emptied at regular intervals. Many children are prone to neglect the calls of nature, and they should be very thoroughly instructed in the necessity of attending to themselves in regard to both the movements of the bowels and the passing of water. Eating and heavy drinking on going to bed or just before, should be avoided.

Continence and Celibacy.—Although harm may not result from continence, it is perhaps true that such a course is not likely to preserve virility. Also, it is true that a failure to exercise these powers may possibly result in a lack of general physical development and virility in life's later years. A natural life is therefore the best.

Naturally this question of continence is a subject upon which, as on many others, the "doctors disagree." And yet it must be said that among physicians the preponderance of opinion is to the effect that strict continence is detrimental, that it is conducive to a lessening of potency and sometimes to impotence. Many physicians are convinced on this point. If they are right, however, the question still arises as to why their contention is true.

If strict continence may sometimes be harmful, is it because of true continence in the sense of chastity, that is to say, chastity not merely in action, but in mind and thought? Or is it in many cases because of the practice or policy of attempting to defeat Nature by continence in respect to conduct while observing anything but chastity in respect to thinking?

Herein is one of the greatest of all evils to be found in connection with the sexual life. It grows out of an unwholesome and morbid interest in sex matters and the continuous stimulation of that interest. It may be said to be a case of "playing with fire," trying to see how close one may come to it without getting burnt. It consists in a policy of stimulating both imagination and desire, and at the same time preventing the complete physiological satisfaction of the desire. If the passions are aroused there is a physiological requirement in the way of their gratification. Even if this gratification is not always moral, at least it is always physiological, and if the natural culmination of this force is prevented, it is only with detriment from the physiological standpoint, and especially from a nervous standpoint. In this respect women probably suffer more frequently, this being especially true of unsatisfactorily mated married women. Thousands of

nervous, emotionally unsatisfied women could testify upon this point. They could, if they wished, tell harrowing tales of sleepless nights, of nervous agony, of a form of torture from which there has seemed to be no relief, no rest.

The results are not only of a nervous character. They are equally pronounced in their directly physical and organic consequences. Prolonged and repeated congestion of the parts concerned makes for weakness and abnormality. Among women this form of psychic self-abuse makes for a form of discharge known as leucorrhea, to aching ovaries and sometimes to serious inflammation. In the other sex this congestion is conducive to weakened and enlarged veins, or more specifically, to varicocele, to swollen and aching glands, and particularly to enlargement or inflammation of the prostate, along with disturbances of function in various degrees.

Of course the solution of this problem in the case of the unmarried is both plain and simple. It merely calls for a condition of mental chastity. Apart from the natural associations of normal married life, the only healthy rule is that one should conduct himself or herself in such a way that the sex instinct is not awakened. One should avoid the associations which call into activity the slumbering forces. Let them slumber, and they will do no harm.

And so it may very well be that the chief reason why continence has been found to be harmful in many cases is to be found either wholly or in part in this condition. Any reference to the suppression of sex may be taken as having two possible meanings. There is, first the suppression of desire, that is to say, maintaining an unawakened sex instinct through avoiding exciting circumstances, associations and influences, which is a simple and probably harmless matter. And on the other hand, there is the suppression of aroused sex passion, which is a very difficult thing and also from a health standpoint a harmful thing.

The bachelor in remaining unmarried presumably elects to live a sexless life. If he really does so in mind and thought as well as in conduct, he will probably suffer very little in respect to the weakening of his potency. On the contrary, he will very likely experience an abundance of energy, the sex-force being diverted into other channels of thought or work. But if a married man, living in close association with the woman for whom he feels a strong and warm affection, and whose possession he naturally desires within the limits of the healthy association suggested in these pages, and yet through some theory of

disciplining his spirit or for any other reasons determines that both he and his wife shall live a life of rigid continence, then it is only to be expected as a result of this practice that he will suffer in respect to his nervous forces, his mental energy, his magnetic qualities and his general vigor.

Of course this question as to the possible harm accomplished through strict continence in conjunction with true chastity of mind and thought is the very point in dispute among physicians. Perhaps this state of complete mental chastity is not common. And yet one may suppose the case of an idealist, perhaps a religious worker, who has entirely suppressed the sex instinct. The claim is made by many physicians that in this way such a person will in time produce more or less atrophy of the reproductive organs, or loss of physiological or functional vigor in this respect. Whether this result will develop in all cases, or to a varying degree in different cases, remains unsolved. Unquestionably there is a strong basis for the recommendation of fairly early marriage with the assumed advantages of a normal sex life.

A man who follows his natural instincts and becomes a husband and a father in his twenties or thirties will expand mentally and physically and will doubtless as a result be stronger, healthier, more ambitious and more capable than if he had stifled his nature and remained a celibate throughout life.

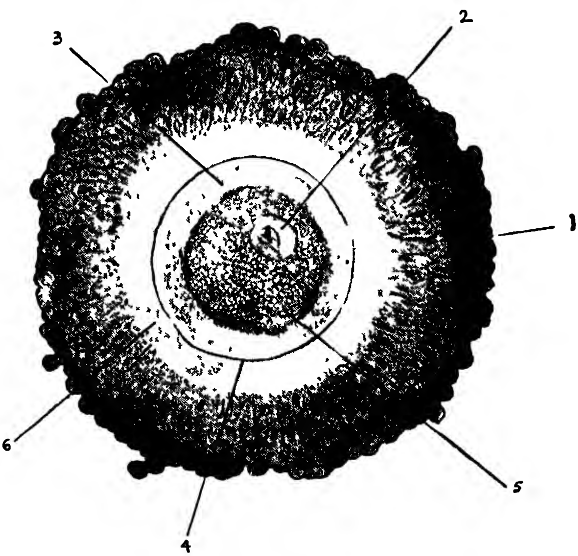
Whatever view we may take of the various theories in regard to these matters, it should be said that under no circumstances must the sexual act be undertaken if one is under the influence of physical weakness or fatigue or unusual mental strain, nor when it is found that languor or depression follow it.

Altogether, taking a practical view of the subject, it would appear that a continent life is generally advantageous up to marriage. It cannot be too strongly emphasized that the growing youth and unmarried man should hold himself to as high a standard of sexual cleanness as he expects from the woman who is to be his bride.

Eugenics.—This matter of wise selection for marriage, which at the bottom is presumably selection for parenthood, has a far wider significance than the individual question of what kind of children will be reared in one's own particular family. Its most important aspect is really that which has to do with the improvement of the standard of the entire human race. *Eugenics* is the name of the modern study of science which is concerned with racial improvement through the better breeding of human beings, this to be accomplished partly by

encouraging the marriage of those who are normal and sound in every way, but especially by discouraging and preventing the reproduction of those who are unfit for parenthood. The field is a large one, and a considerable number of earnest and scientific investigators are now at work studying and disseminating the important truths along these lines which the world must eventually learn. The consistent physical culturist, in the broad sense of the term as it applies to racial improvement, will therefore naturally concern himself with putting into practice the fundamental principles of this new science.

Eugenist enthusiasts believe that their movement is the most important ever undertaken; that it will be largely instrumental in saving modern races from the national decay which has swept into oblivion the civilizations of antiquity; that the subject of heredity, in this connection, is one of the most important and vital of all human studies; and that if we can get the right people born into this world, while the wrong people are not born, producing a race of normal, sound, healthy and vigorous individuals, then all of our social evils, our economic and industrial difficulties, will be eventually overcome. It is a big and splendid program, and there is no doubt that the large and growing host of physical culturists throughout the world will do more than any other force toward bringing about this great result.



Structure of human ovum, in the ovary. 1, Corona radiata, surrounding the ovum; 2, nucleus, containing a nucleolus; 3, protoplasmic mass; 4, perivitelline space; 5, yolk or dentoplasmic mass of fatty and albuminous granulis; 6, zona pellucida, a transparent membrane, within which is the ovum proper.

The Process of Reproduction.—The method of reproduction differs somewhat in the lower and higher forms of

life, though persisting through all of them is the common principle that each new generation springs from a cell of the parent body. The very lowest forms of life consist of a single cell, and in this the process of multiplication consists merely of the spontaneous division of this cell into two cells, these again subdividing in the same way indefinitely. This method is called *fission*. Such multiplication, without sex, is also called *asexual* or *nonsexual* reproduction. Ascending the scale of life from the unicellular structure to others that consist of an organized group of cells, we find a very similar method of asexual reproduction known as *gemmation*, which consists of "budding," or in other words of the formation of buds or gemmae upon the wall of the parent body, these buds becoming detached and thereafter maintaining a separate existence, reproducing in turn by the same method. Certain flowerless plants multiply in this way, as well as some of the lower animals. Not only can a starfish repair the loss of a tentacle, but from the severed part a complete new animal can be developed. A newt can reproduce from an amputated toe, and every tissue, muscle, bone, nerve and skin will be in place.

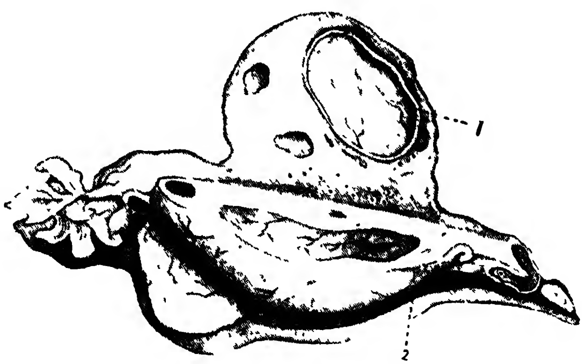
In the higher forms of life, however, both plant and animal, reproduction is sexual, or in other words, accomplished by the union of cells from the two separate sexes. The familiar study of botany has taught many school children the method of reproduction in plants, showing how the tiny seed in the ovary of the flower requires fertilization by the pollen from the stamen of another plant (or from its own stamen in some self-fertilizing varieties) before it forms a complete seed from which another plant will grow. The essential principle is practically the same in animal life, though with some variations in the manner and circumstances of the development of the embryonic cell. The lower in the scale of life, the greater the power of reproduction, numerically considered, apparently allowing for the probable waste and destruction of life that we have already alluded to, while the more complex and perfect the organism, the more limited the capacity for offspring, and the greater the dependence of the young and the parental care required for its protection and sustenance.

The specific act of generation in human life and among all of the higher animal forms involves a union of the two peculiar parental cells or germ-cells, the "germ-cell" or ovum of the female and the "sperm-cell" of the male. The germ-cell, upon being fertilized by the sperm-cell, or spermatozoön, which has the power of independent and continuous self-movement, is embedded in a mass of yolk, this

supplying early nutrition to the embryo. In the case of the fishes, the eggs of the female are deposited in vast numbers in warm shallow water, where they are hatched out by the rays of the sun, after having been fertilized by the fecundating fluid given off by the male as he swims over them. Among the birds, a far higher order, a comparatively large egg is produced containing within its wall sufficient nutrition and even air to supply the needs of the embryo until its organization is well enough completed to enable it to break its way out into the world. In the case of the highest class of vertebrates, the mammalia, in which classification man is placed, the embryo, instead of being nourished by a quantity of nourishment stored up in a well-walled egg, secures its sustenance directly from the system of the mother, comes to life and continues the process of its development for some time before it leaves her body, and even then, for a certain time, continues to depend absolutely upon the tissue-building materials from her milk glands. The name *mammalia* is given to this class of animals because of their breast-fed infancy.

The details of the development of a new human life, after its conception, and of its coming into the world, will be taken up in a later section. Similarly, the anatomy and physiology of the generative system, both of women and of men, together with the disorders from which they suffer and the most effective remedial methods, will be taken up in later sections of the present volume.

Each new generation, as we have said, springs from the germ-cells of the preceding generation. The germ-cell is not, however, as the primitive savage might suppose, a miniature of the completed individual, but merely contains the peculiar forces or potentialities which when developed and elaborated will take the form of a com-

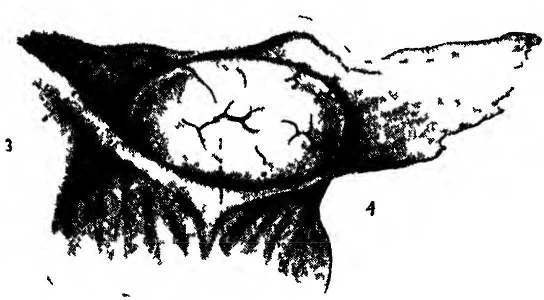


Sectional view of interior of human ovary, about one week before menstruation (cut open and top placed up at right angles to the other half). 1, A mature Graafian follicle; 2, prominent point where the bursting of the follicle might be expected.

plete individual, reproducing the characteristics of the parents and of the parents' forefathers These qualities in the germ-cell, which determine the character of the creature into which it will develop, may be called determiners They naturally differ widely among the different species of animals and to a certain extent also among individuals of the same species It is these peculiar chemical and physical differences in the fertilized eggs of different animals which are responsible for the fact that one will develop into a race horse, another into a heavy draught horse, another into an elephant, another into a mouse, and yet another into a man; or which, among men, will make it possible for one to develop into a philosopher, another into a mechanic and another perhaps into little more than a loafer.

The germ cells naturally depend upon the blood for nutrition, and may likewise be affected by poisons circulating in this life-preserving stream, facts the significance of which we shall later consider. However, aside from such influences, there is a measure of seeming independence of the germ cells from many influences that affect the somatic cells, so that mutilations and other impressions upon the latter do not necessarily always affect the former, making possible sound and normal offspring from one who has been maimed One does not inherit all of the characters or qualities of the parents, but only the determiners for their inborn characters. Important aspects of this fact we shall also take up later.

Male and Female Germ-Cells.—In accordance with the wonderful principle of the division of labor which characterizes the make-up and functions of all forms of life except the very lowest, the male and female germ-cells assume a somewhat different form. For one thing, a certain amount of nutrition is required to provide for the



Ovary and Fallopian tube of young woman The body of the womb is at the extreme left of the illustration. 1, Connection of tube with the womb; 2, Fallopian tube; 3, ovarian ligament, attaching to the womb; 4, ovary; 5, limit of peritoneum; 6, scars of previously ruptured Graafian follicles.

first stages of the development of the embryo, and, in the second place, the power of movement is necessary in order to bring together the two parental elements. The female germ-cell, therefore, takes the form of the ovum, or egg, and as such is incapable of movement, while the male germ-cell, which we have called the "sperm-cell," takes the form of a spermatozoön, is comparatively unimpeded with nutritive or other matter, and has a very active power of self-movement. But while the ovum is naturally larger than the spermatozoön, they are of equal power in the matter of hereditary transmissions, and, in both cases, the essential process of the ripening or "maturation" of the germ-cell is practically the same.

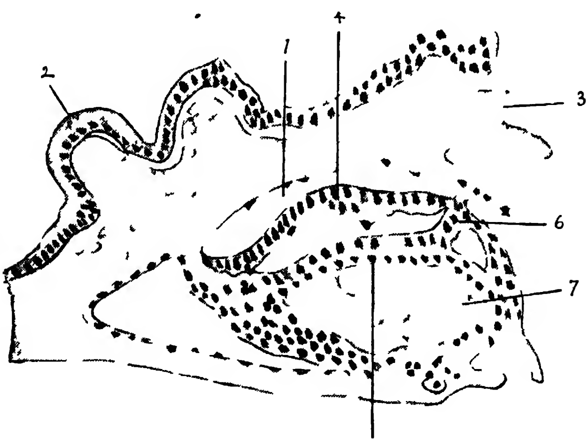
Union of Germ-cells.—For those purposes with which we are here concerned, it is not necessary to go into all of the biological details of the development of a cell, though a very brief indication of the process will be interesting and helpful.

The germ-cell consists of a protoplasmic meshwork, usually called the cytoplasm, in or near the center of which is the nucleus. *Protoplasm* is a general name applied to the substance of living cells, forming the physical basis of life. As a concrete illustration of its nature, the reader can perhaps do no better than to think of the white of an egg. In the nucleus, which is the important part of the cell, the center of its activity, there is a recticulum or network, called the chromatin. It is now believed that this chromatic material is the bearer of the hereditary forces or determiners. The fertilization of the ovum brings together in equal parts determiners from the father and the mother, but apparently to avoid doubling the number of these with each new generation there is a curious division of each germ-cell, and of the determiners contained in it, before this fertilization can take place. Indeed, the process of the ripening or maturation of the germ-cell seems to consist essentially in this division of its chromatic material, or of the chromatic bodies. And though the male and female germ-cells are of different size, as we have seen, yet they possess the same amount of chromatic material.

By this elimination of half of the chromatic bodies on each side, the union of the male and female parental cells will finally give the embryonic cell the normal number of chromosomes, as these bodies are sometimes called. There are really two divisions of the chromatic material, that is to say, one first division and then another subdivision, because each one of the chromosomes is double in form, containing components originally derived from both the maternal and paternal

germ-plasm. These, therefore, are divided, so that each one is single in form. So that finally, each original germ-cell, upon maturation, has given rise to four ripe cells, with chromosomes or determiners of both paternal and maternal origin distributed, apparently by chance, among them. One ripe germ-cell, therefore, may carry a quite different combination of determiners from another ripe germ-cell of the same individual, and in the combination of these from both parents, may be produced children which, even though in the same family, may be very unlike each other.

Heredity.—In the light of the above facts we are able to understand many things about heredity which otherwise would be very puzzling, or which might lead us to doubt the constant play in human lives of hereditary forces. The fact that a child may seem to lack some quality that the father has, or may possess in marked degree some quality which neither parent displays, was formerly a great source of confusion, inclined to make one skeptical or perhaps to lead him to suppose that various external influences played a more prominent part in the formation of each individual character than is actually the case. We now know, however, that heredity is one of the most persistent and unfailing of all forces in this universe. When we are surprised at the sudden display of some peculiar talent in an individual, the other members of whose family give no indication of it, we know that it is truly an inherited quality, and that somewhere in his lineage, perhaps in a grandmother on one side, or a great-grandfather on the other, the same talent or peculiarity existed. And we know why the son of a genius, although gifted in the same way as his father, may have only a part of the father's ex-



Cross-section of human embryo at a very early stage, showing first formation of membranes and parts. 1, amniotic cavity; 2, chorionic ectoderm; 3, chorionic mesoderm; 4, embryonic ectoderm; 5, endoderm; 6, embryonic mesoderm; 7, yolk-sac.

treme aptitude in his special line of study. We see that in the division of the chromatic bodies in the germ-cell, the coming child may secure some qualities of the parent and not others, may inherit, through the side of one parent, either traits of both grandparents on that side, or many traits of the grandmother with few of the grandfather. All apparent discrepancies in heredity could be explained by an understanding of the subject.

There is still much to learn in regard to the exact laws governing the inheritance of family characteristics, but at the same time the average man, busy with the affairs of everyday life, really does not need to make an extensive and scientific study of the subject in order to appreciate the fact that the feeble-minded ought not to perpetuate themselves. If only the general public were as well informed on these matters as they are upon the geography of the earth, or the position of the latter in the solar system, and its manner of creating the seasons by yearly encircling the sun, the practical results would soon be apparent in the improvement of the race.

It scarcely seems necessary to take the time and space here to offer tables showing the percentages or proportionate numbers of children who will and who will not inherit certain characteristics when some of the ancestors are lacking in them, because it is sufficient for our present purpose to know that in such cases the children will vary, with the chances that the greater number of the children will have the characteristics. So that when there are undesirable qualities even in one grandparent, aunt, uncle or cousin, there is a chance that the offspring will have them, which should make the mar-

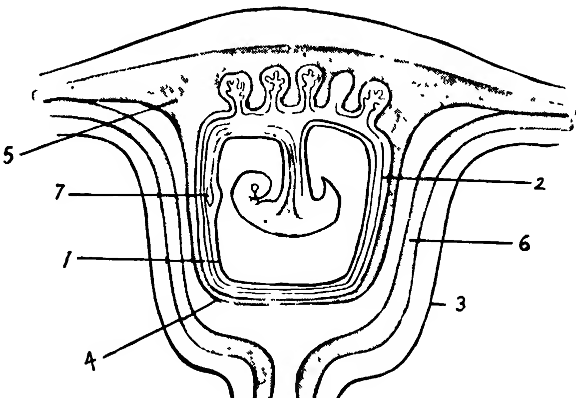


Diagram showing womb in early pregnancy, the embryo floating in the liquor amnii in the amniotic cavity, and the relation of the fetal membranes. 1, amnion; 2, chorion; 3, muscular wall of the womb; 4, decidua reflexa; 5, decidua basalis; 6, decidua vera; 7, yolk-sac.

riage undesirable on that account. And we may remember also that the offspring cannot avoid a characteristic or quality either when both parents possess it in full strength, or when both grandparents on one side possess it.

There are, indeed, several important special conditions or qualities which make for parental unfitness, which we may consider separately, but as appertaining to the general subject of heredity in its relation to selection in marriage there is one principle that is very important to keep in mind, namely, the difference between superficial, acquired qualities which are not transmissible, and those which are inherent and transmissible. One can scarcely attempt to judge intelligently in selecting the father or mother of the children to be, without understanding this matter. Briefly, the fact is that one transmits those qualities with which he was born, those which are in the germ-plasm, but not the superficial characteristics and modifications which have come about through artificial conditions, culture, education, special training and environment generally.

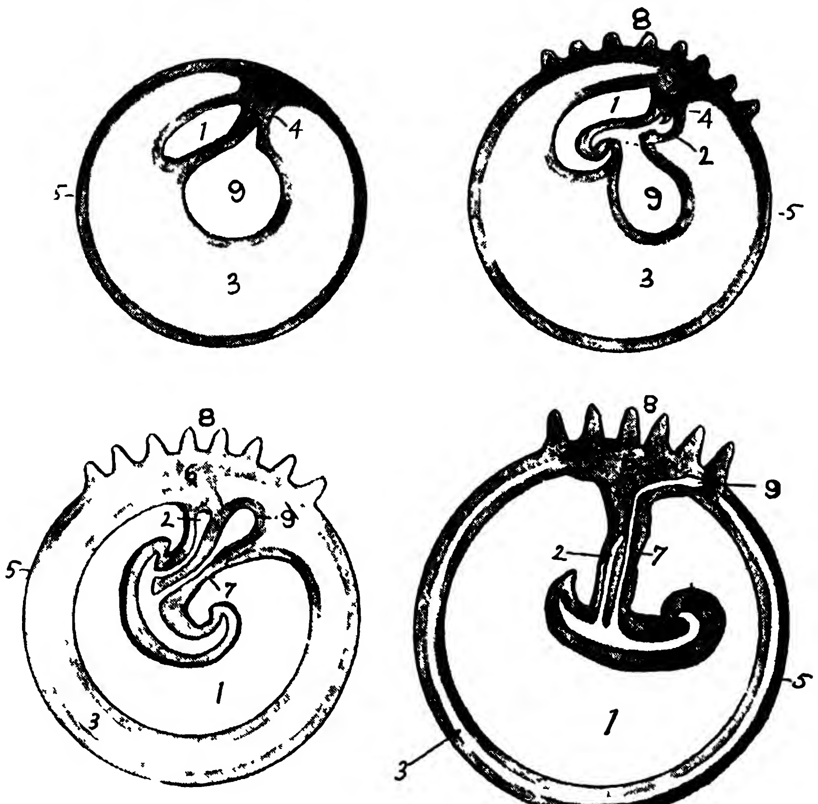
It may be seen that it is not wise to attempt to judge of fitness for marriage and parenthood by the mere surface qualities of an individual. One should ascertain as much as possible of his family. Are they all sound and normal? Or are some of them defective? Sometimes there are latent defects in the protoplasm which are not apparent in some members of the family, but which crop out in others for reasons that we have already referred to. Although a certain member of the family whom you desire to marry may seem to be normal, yet the fact that there is insanity among the brothers or sisters, or among aunts and uncles, should show the possibility of his passing down through the germ-plasm the peculiar deficiency or defect of organization which will result in a part of your children being defective in this way.

Hemophilia is a very good example of a hereditary weakness or defect which illustrates this point. Sufferers from this condition are commonly called "bleeders" because of the characteristic symptom, but curiously enough it is confined entirely to men. The daughter of a man suffering from hemophilia may be perfectly immune herself, but may pass the disorder down to her son. Genealogists have found that a single "bleeder" settling in the United States in the early days was responsible for starting whole colonies of those so afflicted in several parts of the country.

Color-blindness, likewise, is hereditary, and though it may usually

be regarded as of comparatively little importance, yet it is a matter that would need consideration by an artist who desired to pass down his talents unimpaired by any combination with a defect of this character. Albinos, in addition to their mere lack of coloring pigment, are thought by some to be otherwise lacking in the chemical and physical constituents of complete organization of natural hereditary factors.

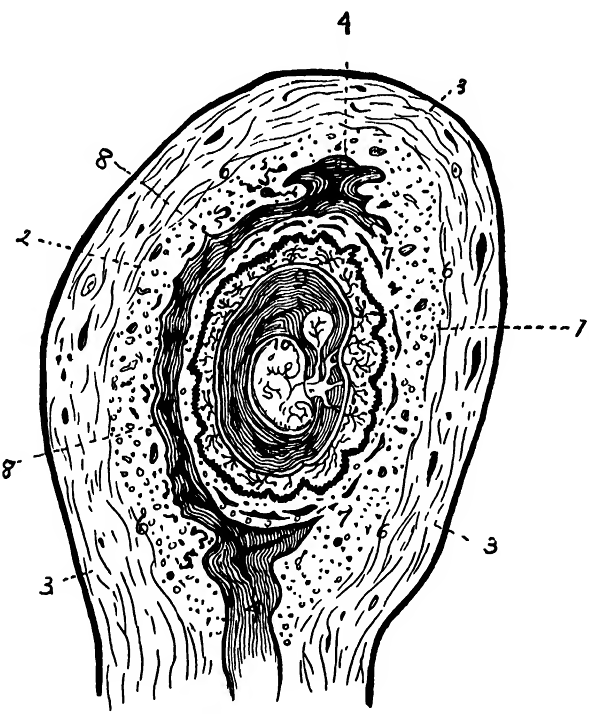
The congenital deaf and dumb, when intermarried, will invariably bring forth children who are deaf and dumb. Such perpetuation is not desirable and should not be permitted. Nor should the normal



Diagrams illustrating method of early development of the human embryo and the formation of umbilical cord and placenta. 1, Amniotic cavity. Note how it gradually enlarges and surrounds the embryo. 2, Allantois, a rudimentary excretory and respiratory organ; 3, space surrounding embryo; 4, belly-stalk; 5, chorion; 6, placenta; 7, umbilical cord; 8, chorionic villi; 9, yolk-sac, which gradually shrinks.

individual mate with one afflicted in this way. But when the defects are the result of accident in one born normal, normal children may be expected.

Criminals who are criminal by nature and instinct should not be allowed to reproduce, for there is no question about the hereditary transmission of their peculiar form of degeneracy. And herein should be sounded a warning against the old-fashioned romantic notion of marrying a man to reform him, for when his condition is the result of a deep-seated and radical flaw in his nervous organization, the hopeful efforts of a well-meaning but too sentimental wife are predestined to failure. There are plenty of authoritative records to show the cost to human society of permitting even one or two of this type to marry. In the blind multiplication of their kind they have given rise to whole tribes of criminals, prostitutes, paupers and degenerates, not only working mischief and murder among their neighbors but entailing a tremendous expense to the community at large. A single pair of degenerates are said to have given rise to a family of some six hundred, of whom more than three-fourths have proven to be degenerate. Surgical sterilization of



Diagrammatic outline of womb with fetus at five weeks. 1, Front wall of womb, with placenta forming and attached; 2, posterior wall; 3, muscular substance of walls of the womb; 4, cavity of the womb; 5, decidua vera, with grooves and prominences showing glands and blood-vessels; 6, base of decidua, with deep glands; 7, decidua serotina; 8, decidua reflexa; 9, chorion with villi, shown in cross-section; 10, embryo.

such is to be recommended, and is even now practiced and demanded by law in some localities.

Insanity and feeble-mindedness are unquestionably qualities of unfitness. It is true that there seem to be forms of temporary insanity or mental derangement, not the result of any inherent mental defect, to which this may not apply. Much care and discrimination should therefore be used. Where other members of the family have been known to suffer, one is pretty well assured that there is a tendency of this kind somewhere in the germ-plasm, or as people say, in the "blood." It is sometimes said that a man breaks down and goes insane under the pressure of overwork or the strain of excitement, but we should remember that other men of more perfect and well-balanced organization also overwork and even suffer a breakdown in health, without going insane, this unfortunate result probably occurring in the former case because there was some inherited weakness or deficiency which made it possible. And then, again, insanity is often the result of some disease, vice or poison which completely undermines the system, or sometimes the result of an injury. It is quite clear that where there is insanity in the family and the tendency is transmissible, marriage is undesirable. And surely, where it has supervened as a result of vicious habits and blood-poisoning disease, marriage is to be absolutely prohibited on account of the disease, though a healthy, normal brother would be unobjectionable.

Syphilis is now known to be one of the most common of all causes of insanity, investigations in some quarters having shown that a very large percentage of those brought under observation had suffered from this disease, sometimes twenty or thirty years earlier in life. The use of mercury and other strong drugs prescribed in the past in numerous cases for the treatment of syphilis results in a degeneration of the brain cells and permanent injury to the nerve centers which ultimately leads to locomotor-ataxia, insanity, and perhaps even to paresis. This disease and its rational treatment are fully discussed in Volume II, page 1156.

There are hundreds of thousands of feeble-minded persons in the United States, and as yet there has been little or no effort to check the process of their multiplication. We are confronted with the appalling fact that they are even permitted to associate and to have children in some of the very institutions provided for their care. Their offspring are bound to be defective, including criminals, prostitutes, paupers, as well as all varieties of feeble-minded, epileptic,

insane, and generally degenerate characters. At least, each one of us, individually, can exert his own influence in his locality against the intermarriage of such, or their mixture with normal and healthy strains.

Regarding *idiocy and imbecility,* it is clearly unnecessary for us to speak, for no one can question the crime either of allowing such to propagate or of immoral relations with them on the part of healthy men.

Epilepsy is well known to run in families, for although the disease itself is not inherited there seems to be a peculiar deficiency of the nervous organization which makes the victim susceptible to it, just as a similar weakness may predispose another to insanity. In the course of smoothly running events and in a state of good health these derangements may not assert themselves, and the importance of physical culture in cases of this kind cannot be overestimated. They should try to live outdoors, avoid exciting, nerve-exhausting influences, and take advantage of every possible means of maintaining a normal physical condition. In this way they may live through their entire lives without suffering from these distressing disorders. But yet, when in poor health, and under the stress and strain of trying circumstances, the inherited weakness will assert itself. One should think long before marrying into a neuropathic family, for, certainly, it is always better to select those whom one may be sure are absolutely sound in every way.

Susceptibility to disease in many other cases is similarly the result of a peculiar lack of resistance which seems to run in the family. It is well known that many diseases run in families, this being true not because they are inherited in themselves, but because a tendency toward such diseases is said to be inherited. This "tendency," however, is invariably the lack of vital resistance. And in practically every instance, these diseases may be avoided by maintaining a high degree of vitality and a pure state of the blood.

Tuberculosis, for instance, will not be acquired if one lives a normal and healthy life, no matter if the death through this disease of many others in the same family may have proven the presence of a peculiar susceptibility to it. We mention this disease particularly because there is so much discussion as to whether or not it is well to marry into a consumptive family. As a general thing it would not be advisable for two persons from consumptive families to marry each other, for some of their children at least would be exceptionally lacking in the

quality of resistance to this disease, and perhaps in the general fund of vitality. A member of a consumptive family, however, should not necessarily be discouraged from marrying one whose family is strong and vital, and who would therefore supply what the other is lacking in this respect. This is a disease that will eventually be stamped out, or at least will be completely eradicated from among those with sufficient intelligence to learn the lessons of right living and health building which we are striving to teach. And what we have said in regard to consumption applies also to diseases of the kidneys and most of the other disorders that seem to be "hereditary."

Alcohol.—It is a matter of common opinion that it is an unfortunate thing to marry a victim of chronic alcoholism because of the personal inconvenience of living with him and the poverty which is almost certain to accompany it except in the case of the man of wealth. But truly the most vital reason for not marrying such a person is his unfitness for parenthood. The poison alcohol is not only detrimental to the individual but destructive to the race as well. While, as we have seen, the germ-plasm is fairly well protected against ordinary external influences, and even against injuries and changes in the person of the individual, yet this poison so thoroughly impregnates every fiber and tissue of the body that it reaches the very germ-cells themselves. The germ-cells are nourished by the blood, and when the body tissues are deteriorated by alcohol the germ-cells are so affected as to give rise to defective children. Such children start life with imperfect nervous systems and a defective brain development. While feeble-minded, insane and epileptic parents beget demented, epileptic and otherwise neuropathic children, it appears that all of these conditions may also be the result of years of soaking in alcohol of the germ-plasm from which they sprang. A man who had formerly had several normal children has had imbecile offspring after becoming a drunkard. Similarly, a woman who has had feeble and sickly children, dying in infancy, by a drunkard, has afterward had sound and vigorous babies by a healthy, normal man. Certainly, no one can afford to marry a drinking man, either to reform him or for any other reason, or, if married to one addicted to the habitual use of this poison, one certainly should not have any children by him after the habit has been acquired.

Health Certificates.—The question of venereal disease is one which every woman contemplating marriage should take into consideration, for where the so-called "black plagues" are common and

widespread there is always the danger of frightful consequences to the union.

The poison of syphilis, far more than alcohol, exerts its pernicious influence upon the germ-cell, causes defect and deformity in the offspring, and transmits the disease itself. The horrors of this disease, both in the individual and in its transmitted form, are among the most hideous facts of our sordid and disgraceful civilization. The disease is discussed in a later section of this volume, but we have referred to it here because of its relation to heredity and the question of marital selection.

The other black plague, gonorrhea, is likewise far more serious than commonly supposed. Though it seems local in its manifestations, as compared with the deeply-rooted and constitutional character of syphilis, and is not transmitted to the offspring in the same way as the latter, yet there is always the danger of infection of the child's eyes in the course of its birth. Gonorrheal conjunctivitis is truly a most violent form of disease, requiring usually not more than three days to accomplish the complete and irreparable destruction of the sight. A very large percentage of all those who have suffered from blindness from birth are the victims of this particular infection, growing out of the past vicious folly of the father. If the prospective wife is not influenced by the possibility of a condition of this kind, then she will find food for reflection in the fact that in countless thousands of other cases gonorrhea is responsible for complete sterility or perilous surgical operations in which the abdomen must be cut open for the removal of hopelessly diseased parts. Not an alluring matrimonial prospect! This disease, also, is taken up in detail later in this volume.

It is obvious, then, that venereal disease means unfitness for marriage or parenthood. Marriage under such circumstances is a crime of the most heinous type, even though not subject to legal punishment. Although these diseases may be cured in most cases by very strict adherence to natural treatment, yet the patient should forego marriage at least for the period of time that may be necessary in some instances to thoroughly eradicate from the system all traces of the poison.

Faith in the man of her choice is one of the beautiful traits of a truly feminine nature, and such faith in his good health and pure blood is to be expected in practically every case, even when it is destined to be blasted by the hideous developments and discoveries

that will follow marriage. Such faith is more beautiful than safe. Again, the first victim of the disease may regard himself as "cured," because the external manifestations may have been temporarily smothered or obscured by medication, while in reality the virus of the plague is still strongly intrenched within his body. The question of disease is a question of fact, a fact which may be and should be ascertained before joining hands in wedlock. Any normal and right-minded young man will be anxious to protect his intended wife and at the slightest suggestion will be glad to secure and present a certificate of his health and cleanliness. If there is doubt in the matter, the certificate should come, not from the family physician inexperienced in such matter, but preferably from a specialist. Though one may not approve of all the methods of treatment employed by such a physician, yet the question of the presence of the disease is a question of fact which he is able to determine absolutely. Because of its import, this point is discussed elsewhere in this volume.

Hurtful Habits.—The deleterious and tragic effects of narcotics and poisonous drugs upon the individual are well known, but their results upon offspring have not been sufficiently observed and studied to enable us to say very much authoritatively regarding them. Alcohol is unquestionably the most widespread of such poisons, but there is good reason to question the safety of marrying anyone who has been or is the victim of heavy dosing with narcotics or any other poisonous drugs.

Marriage and Its Purposes.—Marriage is the most important voluntary step in life. The three events of absolutely overshadowing importance in our mundane existence are our birth—with which we ourselves have naught to do; our deaths—for which we personally are rarely directly responsible; and marriage—in which normally, we are governed by our own volition. Marriage is a serious proposition both for the man and woman immediately concerned, and for the children that ought to be the fruit of their union. Yet marriage is and doubtless always will be a matter of individual will and preference. This fact can never be overlooked.

Another weighty consideration should not be forgotten. Too many young men and women enter marriage with the idea of the *advantages* they are going to gain. Here, again, is a fatal mistake. True marriage, both for man and woman, should be a state of loving service, a free and cordial *giving* rather than a *receiving*. If one marries simply to get, he will get only what he marries for, and

unless marriage teaches him wisdom he will be sadly disappointed in what he receives. Like Dead Sea fruit it will turn to ashes on his lips. If, on the other hand, he marries to *give,* he will receive back all he gives and immeasurably more. This is a practical law of life that never fails, and wise indeed is that young couple that has wisdom and forethought to appreciate it.

True marriage is a mental and spiritual partnership as well as a physical and worldly one and the true husband gives as much as he takes and should receive only as much as he gives. In other words, marriage gives the opportunity for the necessary completion of the life of each partner and neither side has any advantage or disadvantage over the other. A man should bring a clean and chaste body and mind, with a pure soul to his wife, just as much as a wife should bring her chastity and virtue to him. Any other standard is wrong, because one-sided and unnatural, and when a man and woman enter the married relationship the man should have just as much purity to give as has the woman.

Marriage and Age.—Marrying at the most suitable age, and finding a mate of the presumably ideal age in relation to one's own, will not in themselves insure marital happiness or make a success of the alliance if the other primary factors of attraction, temperament, physical fitness and adeptness in the art of love are lacking. Suitability of age will not make up for other failings or deficiencies. And yet departure from such suitability may well contribute to the failure or the causes of failure.

Results favor early marriage, but not premature marriage. Mating before the age of eighteen for women, or twenty-one for men, may be regarded as premature. Premature is the right word, because complete maturity is really not reached until sometime after these ages, even though puberty is arrived at several years earlier. Nature, as an added precaution for perpetuation of life, frequently establishes the ability to procreate before full physiological development occurs, and before ideal biological conditions may prevail.

In the Orient many races take Nature's arrangement seriously, regarding puberty as the indication for marriage. The result is the wide prevalence of child marriages with most unfortunate results, including childbirth at an age when the body is not yet fully developed and ready for this burden. The child wives of India present a pathetic spectacle. Fortunately and wisely, our Western civilization has developed the tradition of postponing marriage until physical and

mental maturity have been attained. Premature marriage is, among ourselves, very unusual and probably never to be recommended.

Early marriage, accordingly, may be taken to mean a wedding at any time during the first few years of maturity, that is to say, between the ages of twenty and twenty-five. And that appears to be the ideal age in which to marry. This age represents the period of maximum vitality. It is during these years that sprinters run fastest and create new world records, and boxers win championships. And during this high tide of vitality the surging flood of sex energy, more or less sublimated, most readily and most powerfully manifests itself in the romantic impulse. As a matter of fact, more women also marry at this time of life than at any other period, and since a similar proportion of men marry between the ages of twenty-five and thirty, this indicates that a great many women marry men a few years older than themselves.

For family reasons there are distinct advantages in early marriage, especially for women. After the first child the question of age has little to do with the matter of trouble or pain in maternity, but so far as a first childbirth is concerned, it is far better to have it occur in the early twenties. This does not mean that there will always be trouble for those women who bear a first child after thirty, for that is a matter depending largely upon physical fitness and proper training and preparation; but maternity is usually more easily initiated before thirty than after. It is idle to say that women *ought* to keep their strength and youth and bodily pliability into their thirties and forties, for the fact is that the majority neglect to do this, and so for the majority a first birth after thirty is likely to be a much more severe experience than when it occurs earlier. The reason for this is also largely anatomical, as the older a woman grows the less the soft parts give under pressure and the firmer and harder the ligamentous union between the pubic bones becomes.

Again, from a physical standpoint, early marriage is generally much more satisfactory. From the wife's standpoint, inhibitions that may possibly interfere with her responsiveness will, if she marries late. have been more fixed and more difficult to overcome. Then, again, the man who marries later in life may possibly be a less satisfactory husband in the physical sense. For one thing, the non-athletic man too rapidly loses the quality of youth, and as he approaches forty he no longer has an attractive body. He is usually either fat or too thin and scrawny. But apart from this it may be said that physicians

have found the greatest tendency toward masculine impotence developing in the late thirties. It may be, of course, that after that age men do not so frequently bring their complaints to the physician. Perhaps they believe themselves to be "through" and are resigned to what seems to be their fate. In any case, the complaints on this score come most frequently from men in their late thirties, which means that a late marriage frequently brings to a woman greater disappointment in this important respect. One would think that a man suffering from ineptitude in this direction would not undertake marriage, but it is quite possible that he may not realize his condition. In many cases impotence seems to develop insidiously, the way having been paved through the devitalizing influences of excessive smoking (an anaphrodisiac), excessive use of alcohol, the nerve-strain of business, years of failure to live an outdoor life, lack of exercise and inadequate diet.

Disparity in age is not conducive to companionship on the one hand, and even less consistent with the possibilities of a satisfactory sex life except perhaps for a very short time. This is particularly true where the wife is materially older than the husband. Such marriages are almost never successful. Usually it is the husband who first finds the relationship unsatisfactory. He is not to be blamed for this. It is a perfectly normal reaction in a situation which should never have been brought about in the first place.

When the wifê is only slightly older than the husband we find an entirely different story, but this is doubtless because such a small difference in age, say from one to three years, is really not enough to have any practical effect one way or another. Such alliances may be classed with those in which husband and wife are of equal age, and this group seems to produce the highest proportion of happy marriages. The similarity of viewpoint in those of identical ages undoubtedly counts a great deal, though the fact that the couple are physiologically on the same level of vitality probably has more to do with it.

Of course, some persons age more rapidly than others. One may be older or younger than another at the age of thirty. Some men begin to get old at thirty or thirty-five, and in such a case a youthful type of woman might be three or four years older chronologically, and yet actually younger physically and emotionally. In other cases what might be called the physiological disparity in age might work out in just the opposite way. An unhealthy woman, aging rapidly,

might have been born three or four years after her husband, and yet physiologically be many years older. If we speak of age as a condition of body and spirit and not as a mere matter of years, we can then allow much latitude in this question of disparity of age in marriage, except that undue aging of either a man or a woman prior to middle life would naturally mean more or less unfitness for marriage.

Just here we find the vindication for many satisfactory marriages in which the husband is from ten to twenty years older than the wife, measured in the count of years. Thousands of men who have taken good care of themselves in the way of temperate eating, proper living and a full share of outdoor life are still youthful at the age of forty-five or fifty.

The "Change of Life" and Marriage.—It is true that the *Menopause* (see Vol. II, page 993), need not mean the end of sex activity so far as a woman is concerned; but in some cases a woman's sex interest is somewhat diminished, while the husband's potency and eagerness may continue for many years longer. This certainly has a powerful bearing upon the matter of their relative ages. If the change of life at the age of forty-five does begin to affect the wife's responsiveness, it will be unfortunate for the husband if the two are of the same or nearly the same age, and even more so if she is the older, for he will then be confronted by this development when he is only forty or forty-two or whatever the disparity in years will make him. But if, on the other hand, the husband is older, the fading of her sex interest after forty-five will more nearly coincide with the period of diminished ardor on his part. This may be considered practical consideration in favor of selecting a younger wife, or an older husband, as the case may be.

Marriage Between Blood Relatives.—At one time it was thought that there was some factor in the union of blood relatives that *produced* defect, but we know now that this is not the case. Intermarriage does not *create* insanity or epilepsy or bad eyes or deaf mutism. Actually, the real factor at work in the production of defective children in the homes established by the marriage of cousins is heredity—the same sort of heredity, governed by the same laws, that controls the transmission of life in general and with it the specific traits and characteristics, normal or otherwise, present in the seed. The only difference is that in the marriage of cousins the force of heredity is sharpened and intensified in certain directions, par-

ticularly with regard to what biologists call recessive traits. This means not only that defects in the common ancestors are likely to reappear in the children of cousins and to be intensified, but also that desirable qualities such as mental acuteness and talent may also be intensified.

The advantages or the disadvantages, as the case may be, of the marriage of blood relatives depend entirely upon the *kind of people* that have made up the family for the last three or four generations. If they have been tried and found wanting, then the marriage of cousins promises even worse. It has been so proven with ghastly and shocking results, as with the notorious Jukes family of New York State, and the Dacks of Western Pennsylvania.

If in addition to freedom from defects in several generations the family has been distinguished for special ability along various lines, one may even regard marriage with a cousin as not only permissible, but highly desirable. For one may then develop even higher standards of ability than the family has known in the past. Professor Edwin M. East, of Harvard, after some fine mathematical calculations, reached the conclusion that if a particular defect has not appeared on either side of the house for three generations one may as safely marry his cousin as to marry outside the family.

Temperamental Types and Their Marriage.—Modern psychologists classify most human beings as belonging to one of two contrasting general groups, namely, the introverts and the extroverts, meaning in a literal sense, turning in and turning out, and having reference to the habit of mind, or the interests of the mind in being concerned with thoughts and satisfactions inside of themselves or outside of themselves. The introvert is subjective, the extrovert is objective. The introvert is a thinker, the extrovert is a doer. The introvert is analytical and creative, and tends to live quietly, often alone. The extrovert is sociable and inclined to mingle with people.

This is a modern classification of definite temperaments. We are likely, however, to find so many people who are such mixtures of the two types that we cannot put them definitely in either category. But the psychologist is ready for that. He has a third special group for these mixtures, and he calls them ambiverts; that is, one who combines features of both the other two groups.

Should an introvert marry an extrovert? That is a question subject to discussion. It is, however, generally conceded that it is fairly safe for either an introvert or an extrovert to marry an ambivert.

Two extroverts married to each other would probably be happy together, depending of course upon community of interests and a satisfactory sex relationship. But it does not follow that two introverts would be happy together.

When ambivert meets ambivert, almost anything is possible. Such a combination is quite likely to produce an ideal marriage, depending, of course, upon many things, and if some of these things do not fit in the alliance may prove unsatisfactory.

It should be possible to foresee that certain types, however romantically attracted in the beginning, cannot harmonize. It were far better for two such persons not to marry. But one should not go to a fortune teller or a clairvoyant for advice; one should go to a competent psychologist. Even one's own doctor may not be able to advise, unless he made a study of psychology or is perhaps a practicing psychiatrist. An alternative is to undertake the study of psychology of oneself. Introverts as a rule will avidly read about psychology.

Physical Attractiveness and Marriage.—The loss of personal attractiveness on the part of husband and wife may prove a threat against the future happiness of their home.

Deterioration is a very serious factor in human life, whether it is bodily deterioration, mental decay, loss of emotional quality or just a general fading out of youth in these respects. Women, as a rule, are more concerned about the loss of youth than are men, and apparently have sharper sense of human values. Resort to cosmetics seldom adds, in any degree, to their attractiveness, and in fact when at the same time they grow physically flabby, they often, on the contrary, emphasize their physical defects.

While most men notice the failings as well as the tricks and subterfuges of women, in this particular matter they are much less alive to their own unattractiveness. As to that, however, women are extremely keen. Twelve or fifteen years after marriage a wife finds herself living with an apparently different man from the one she married. That pre-nupital sweetheart was strong, erect, active, vital and physically fit, a good dancer, a strong swimmer, alert and alive to everything. But now he has become either round-shouldered or round-waisted; he is either thin and scrawny or stout and pudgy.

But although man is more easily satisfied, he also has much the same impression of the physical imperfections in his wife. Women also become fat—or scrawny. And even though they may not vary very much from the normal standard of weight they show in other

ways that the animal spirits of youth have gone. They have lost tissue tone, the spring has gone out of their step, their bodies have lost their shapeliness, and everything about them proclaims that their youth is lost.

Were it only a fault of deficiency, a lack of keeping firm and trim, it might be disappointing but it still might not be fatal. Unfortunately, to these conditions there are often added very definite and positive personality factors of a distinctively offensive nature. Physical unwholesomeness is one of the most common and one of the most unforgivable of the vexations that offend most seriously in married life.

Women today resort almost universally to these artificialities of paint, rouge and powder to make themselves attractive when, in reality, nothing but good health and natural vitality can really make them naturally, truly attractive—good health of body plus an appealing bent of mind and feeling. A healthy girl needs no make-up, though when she puts on just a trace of it, it may not detract from her natural beauty. But as she grows older and more conscious of her deficiencies she still tries to continue to look like a young girl, in color at least, so she covers her face with such an excess of rouge and powder that in the end she not only does not look like a young girl but she actually overemphasizes her facial defects. To outsiders this may seem a harmless bit of vanity, perhaps just a little silly, but to the husband it is the rankest kind of affectation, and it is altogether irritating and displeasing.

Keeping young in the thirties and forties is an admirable program—indeed, the proper and only possible scheme of life for men and women of wholesome and normal viewpoint. But that means actually keeping young by keeping fit, through a plan of life that includes right eating, bodily activity, outdoor life and sunshine. To grow flabby and soft by living a stagnant, careless life without any self-improvement plan, and then to try to create the illusion of youth and vigor by artificial means very definitely demonstrates that one is not playing the game.

It is on the physical side that we are apt to slip first. We become soft. We become shapeless. True, the physical side of marriage is not all of it. It is only a part of marriage, but it is a very fundamental and a very essential part of it. And so it is imperative that married men and women should take stock of their physical personalities and observe a plan of life that will keep them attractive.

Physical Contact in Marriage.—The groom must remember that in the case of the inexperienced bride marriage is the beginning of a new life. She is likely to meet it with a natural and spontaneous reluctance, just because it is new and strange. At least, he will be safe in assuming this to be the case. We may be reminded at this point, that many married couples of today did not wait for the legal ceremony to consummate the marriage relationship, and to these there is nothing to be said. The practice is contrary to social welfare, and often contrary to personal welfare. [illegible]

Before proceeding further along these lines, we should perhaps make clear certain fundamentals. These ought to be obvious, yet the extent of marital failure in general proves that people either do not know or do not sufficiently realize the importance of these fundamentals.

The first of these is the law of mutual gratification in the sex relationship. There is no true marriage without it. The husband who gratifies himself and leaves his wife unsatisfied has violated the first and greatest of marriage requirements. He has, without intention, made a mere source of gratification to himself. The fact that in past times women submitted to this because they thought it was expected of them, does not change the fact that this is one of the most essential and most imperative conditions necessary to insure a happy and successful marriage.

In fulfilling this condition there are two things that the husband must do for his wife. First, he must arouse her. Second, he must produce in her complete gratification. This is all part of the one essential, but if he understands it in terms of these two requirements, he will make it a point first to see that she is aroused, for without this the consummation of the marriage relation, at least in the mutual sense, cannot be achieved.

Also (and this is really precedent to the other), there is the law of mutual desire, which means that true physical and spiritual union depends not upon the desire of the husband alone but of both husband and wife.

This profound physiological law of marriage is based upon the sex life of the entire animal world, in which the male is always ready, but the female is only periodically ready. There is an element of this periodicity in the human race as well, which makes it imperative that the wife shall determine the time and frequency of the marriage relation. The old-fashioned husband assumed that the wife should

be at his call. Just the reverse is the case in the scheme of Nature. The husband, normally ready by nature, really awaits the call of the wife. Her own receptivity is the indispensable condition. And unless he obeys this rule, and is obedient to her requirement in this connection, he violates the rigid physiological law upon which happy marriage is based. All of which is of special significance during the honeymoon and the early months of the physical associations of married life.

We are told that the wife must be aroused, in order that consummation may be realized. Just what does this mean? Just what is sex union? What is sex satisfaction? It may be well to make this clear in plain words.

One is often prone to be poetic in any reference to the sex relationship. One is apt to say that it is an expression of conjugal love. Of course it is. That is quite true, and yet it is a hopelessly inadequate statement, relative to a highly natural phenomenon—truly a complex physiological, nervous and psychic experience.

Narrowed down to its physiological basis, sexual intercourse is the means leading to impregnation or fertilization. That is well known. It is, however, accomplished by a unique combination of nervous forces and physiological activity in a high state of excitement. The approach is based upon mutual sex attraction, special receptivity (more or less periodical) on the part of the wife, and the building up of a high degree of nervous tension characteristic of sex excitement. A certain amount of this nervous tension is usually first accomplished by intimate social preliminaries, perhaps culminating in a kiss or embrace, which inaugurates the second stage of ardent love making. Now, this second stage is likely to be unwelcome to the wife except on a basis of agreeable social and emotional preliminaries. The husband who has any sense at all of the art of love will know very quickly when he is unwelcome, and if so he will not persist in his attentions. When the wife is receptive, however, this second stage of ardent love making follows the course of kisses, caresses and embraces of an increasingly intimate nature leading to a higher and higher state of nervous tension, accompanied physiologically by circulatory activity and congestion in the sexual organs. The third stage or stage of actual union involves a more rapid acceleration of this nervous tension leading up to a pleasurable spasmodic climax, or what has often been described as a sort of nervous explosion, followed directly by relaxation or complete relief

of the aforesaid nervous tension, and a general sense of rest and well-being.

In short, though physiological in its achievement, this climax, technically known as an "orgasm," is really a nervous and psychic experience. When successfully accomplished, with the ensuing release of nervous tension, it has a highly tonic effect upon the nervous system, the mind and the constitution generally. That is why happy married life is healthful and conducive to nervous stability and personal efficiency. But if this state of nervous excitement has been induced in the wife, and the union then falls short of bringing about in her this climax or consummation in her case, she finds herself in a torment of nervous tension without relief. Thousands of unsatisfied wives can tell a story of sleepless nights and shattered nerves, leading to broken health, as a result of selfishness or ineptness upon the part of their husbands.

On the part of the husband, the orgasm or climax of nervous forces is identified with and productive of an ejaculation of seminal fluid, through spasmodic muscular contractions and it is this ejaculation, carrying the sperm cells of the male to the proximity of the ovum of the female, that ultimately brings about impregnation of the latter, or what we call "conception," which is the beginning of a new life—the wonder of creation!

One speaks of psychic preparation through love making as a means of dissipating any emotional resistance or reluctance on the part of the bride. But sometimes the bride, because of what she feels is only fairness to her husband, and in trying to do what she thinks is her duty, pretends a readiness or receptivity that she does not feel. Sometimes there is still a measure of involuntary physical resistance, and if this is the case the groom must know that, in her heart, she has not yet surrendered. Until this happens both emotionally and spiritually he must not take advantage of his supposed privileges.

However, it may be as well for the bride to understand, on her part, that her first experience may be disappointing, and especially in the cases where it is necessary that a virginal hymen be ruptured. This is not really so painful as to cause any fear or shrinking, for the hymen is a superficial membrane easily torn aside. Any shrinking is far more likely to be psychological—due to the natural timidity in facing a new experience. Sometimes the rupture of the hymen may interfere with the initial experience, and it is always a matter to be approached gently and considerately. It may be well to have surgical

help if the membrane is seriously obstructive, or to permit two or three days for healing without further disturbance. Often, however, this interference will not be experienced. Incidentally, its presence or absence has little or nothing to do with previous chastity, as in many young women it is very slight and may never rupture, and in many others it is entirely absent. Differences of structure as well as hygienic measures must be considered.

As to the matter of physical resistance, it should be understood that this is an inevitable part of lack of psychic response on the part of the wife and inadequate preparation through love making on the part of the husband. Without this mental and nervous response the wife does not experience the physical readiness manifested in terms of circulatory activity, congestion, erection and expansion of the incidental parts and the characteristic increase of local secretions. Without this physical evidence of desire, even though the wife feels that she should do her duty, there should be no attempt to pursue the marital relation, at least not until this condition is overcome by such a course of love making as will have induced in her the needed responsiveness. Without this local receptiveness in the way of congestion and increased local secretions, sexual union is an irritating and painful assault upon the person. That, perhaps, is an extreme statement, and yet that is exactly what it is in the experience of many newly married women—and frequently, for that matter, among those not newly married.

The Art of Love.—*The Man's Part.* The average husband or prospective husband manages to obtain physical satisfaction for himself—gratification in a sometimes crude and bungling way; but he does not know that there is an art of love that raises the marriage relation to exalted heights, and which will obtain for him an infinitely finer and greater pleasure. Unfortunately he does not usually realize that happy and successful marriage depends very largely upon his own aptitude in the art of love.

In this matter of the marital relationship, and assuming a fairly normal responsiveness or reaction power on the part of the wife, the knowledge and aptitude of the husband in the art of love have everything to do with bringing to her that emotional satisfaction to be found in married life.

It must be made clear to the reader that when referring to the sex relation as a fundamental of marriage, it is not intended to imply that the physical side of marriage is all that there is to it. That is a misunderstanding that can easily arise. Many women conceive the

idea that their husbands so regard it, and that notion in itself is enough to ferment trouble. Manifestly, true marriage is a comradeship, a companionship, a partnership based on mutual love. This love is the expression of bonds of social sympathy and sexual attraction. The nature of that attraction normally is spiritual as well as physical. The love of man and wife may incline somewhat more to one or the other of these phases, but it invariably is a true combination of the two forces, the physical and the spiritual, as it properly should be.

There are those who try to distinguish between love and passion, or love and lust, as they prefer to call it when they wish to emphasize the supposedly base character of physical sex attraction or excitement. And true enough, there is some foundation for such a radical distinction in the impulses and behavior of primitive persons—and of some not so primitive. Our attitudes and reactions in the field of sex are determined in part by tradition, custom and habit, and so among certain classes of men sex is apt to be relegated to a chiefly physical plane. But even the most robust sex adventuring men may, however, finally marry and settle down, because they have been intrigued by a deeper sense of the appeal of womanhood, and because they have finally found that there is much more than mere physical attraction and physical gratification in the relationship of man and woman. Among the more cultured classes there is rarely such a thing as an unmixed physical relationship. There may seem to be in some instances, but there is almost invariably some admixture of the emotional or spiritual factors of sympathy and affection with the physical. People seldom understand the forces that are implanted in their own natures—even the most dominating of these forces. Certainly, the ideal marriage is not to be found except there be a well-balanced mixture of love and passion. The existence of passion in marriage is not to be deprecated; on the contrary, it is often to be welcomed as opening the way to the glorious fulfillment of true happiness in marriage.

In this connection there is a very important matter for husbands to master in the art of love, namely the essentially emotional character of the feminine reaction to sex appeal. This may not be true of all women. That is to say, there are women who lean toward a more physical interpretation of the sex impulse, as do many men. But as a general thing one may depend upon the emotional character of the feminine response. Few women pursue sex for purely physical reasons,

at least not consciously. There must be for them bonds of sympathy, admiration or other elements of emotional appeal. Starting then with just such a tender emotional background, and following adequate preliminaries of genuine love-making, sometimes even extensive love-making, the woman gradually, and more or less unconsciously, is stirred by profound passion, a sublime and all-powerful manifestation that eventually carries her through to the final culmination. If, however, such a deeply moving passion remains unsatisfied, the results are devastating to her own nervous system, and are likely to be equally devastating in respect to her own future personal relations to her husband.

It is a common thing for husbands to wonder what is the matter with their wives when they fail to respond to the husband's approaches. The explanation in a vast number of cases is that the husband's approach is too evidently on a merely physical plane, or so it seems to her, and since she desires more than that, she resents it. She wants to know that he loves her and she wants to be told it in both words and actions. If by his behavior he conveys only the impression that he desires physical gratification, she will resent it and become cold and unresponsive. She cannot respond on that basis. There are, of course, exceptions, as we have already noted, but this is true of the average woman. It is the characteristic feminine reaction. The art of love demands protestations and demonstrations of love in the way of preliminaries that induce a genuinely emotional and spiritual response, and out of this emerges the more definitely sexual response. All this may seem obviously true in the beginning, while establishing a successful marriage relationship, but it continues to be equally true throughout the whole span of married life.

Husbands must learn to realize that there is no greater error than to assume that courtship ends with the marriage ceremony. Unfortunately many men think so. They pursue an intensive courtship up to the time of marriage but after that they seem to feel that now the woman is his property; that from that time on her body is at his service. When he desires her, there she is. That he thinks is what the ring on her finger means. This of course applies to only a certain proportion of men but no matter how small the proportion may be, it is still too great.

It is the wife who must determine when sexual union is acceptable. Of course, if the wife is utterly unresponsive, cold or "frigid," there is in that case no such thing as normal marriage, and that is a problem

of a different kind that we discuss elsewhere. We are, however, speaking here of a situation in which normal instincts and natural conditions prevail, and which offer the possibilities of successful marriage. It is presumed that the wife may be courted and persuaded, at the right time and with proper frequency, but the final decision rests entirely with her.

Sex experience in the human family does not parallel that of the lower animals. With them, mating is for procreation only, and the female will not tolerate the approach of the male except when she is ready for conception. This is not true of the human race or of the primates in general. Among the apes as well as among the humans, the female of the species is sexually provocative not merely at the time when conception is most likely to take place, but at many other times besides.

However, it does not seem necessary to enter here into any comprehensive discussion of this question. It is universally recognized that with us sex indulgence is not merely a reproductive measure. It becomes the supreme factor in the art of love. And yet, even in the human circle there still obtains the universal rule that the female must govern in the matter of sex receptivity, and that unwelcome approaches must not be persisted in. As it happens, however, what seems to be resistance on the part of the wife will often yield and melt away under the influence of a proper course of love-making, evoking a genuine emotional and spiritual response which merges at first gently and then more powerfully into combination with definitely sexual provocation. This is an important part of the art of love that husbands need to cultivate.

Woman's Part in the Art of Love.—It may be said that wives are often the victims of tradition—the tradition of "wifely duties"—the tradition of passive submission. As a matter of fact, that is not what a husband wants. No man wants passive submission from the woman he loves. He wants a sweetheart, a lover, a sex-reciprocating partner. He may not realize this, since he too is often influenced by the traditions of possession and privilege. But the fact is that the mere passive surrender of his wife's body, while it may afford him physical release, is not satisfying in the deeper sense, and is almost certain to lead to the breaking of the ties of love. Ultimately he may seek elsewhere for romance.

The thing for both husband and wife to learn is the rule of complete feminine dominance in the matter of the time and frequency of sex

indulgence, to which we have referred. Just the converse of the advice given to husbands in this respect is true where wives are concerned. Without the desire for active participation on her part, she should not permit the sex relation. There are many reasons for this. But whatever the reason for her unreadiness, she should not yield herself until prompted by aroused desire.

Many wives even mask their feelings, or rather lack of feeling, pretending enjoyment so that their husbands will not think them cold. But whatever the reason, passive submission is almost invariably a serious error and for many reasons. It means that the wife is only making a perfunctory surrender of that which should be the expression and the culmination of conjugal love. It is but an inadequate and one-sided satisfaction for the husband, lacking in the exchange of sex magnetism, and as such is on his part little better than an auto-erotic practice. It places the wife herself in an ignominious position, inevitably leading to reactions of resentment and the building up of a gigantic barrier of sex hostility. And by making herself the too-ready tool to his gratification, she actually makes unnecessary for him the necessity for courtship and the sequence of love-making preliminaries, without which even his own sex indulgence cannot reach its fullest meaning or satisfaction. She virtually trains him in the habit of an unsatisfactory type of sex expression, so that instead of being the fulfillment of love it degenerates into the mere status of an habitual physical release.

It is true that in the pursuance of this law of feminine dominance of the sex life, the husband occasionally—or should we say, temporarily—will be disappointed. But on the other hand, unless this law is strictly followed he is in the long run going to be disappointed in a far more serious way, because the whole marriage relationship will have been established on a wrong basis. Occasional or temporary disappointment will mean nothing if the sex relation is maintained on its right basis as a jointly participating partnership and as the expression and fulfillment of love. In the nature of things, the husband must positively wait upon the pleasure of the wife, and this rule makes it imperative that he should as previously set forth follow the course of pursuit and courtship which inevitably carries the sex activity of both to a far higher level of energy and climax, and consequently to a far greater release and relaxation following its culmination. Indeed, this is the only basis upon which sex expression really reaches its fulfillment.

In short, the course of the modern wife is advisedly a very different one from that of the old-fashioned wife who conformed to what she considered "wifely duties." If anything, the idea of "husbandly duties" in the way of adequate love-making should be emphasized. As we have seen, practically the only sex education the old-fashioned mother gave her daughter, following a life-time history of taboos and repressions, was the injunction given as she was about to be married, to "be good to him," meaning, among other things, never to refuse him sexually, so that he would always find his gratification at home instead of with other women. That, unfortunately, too often was the system followed in previous generations, resulting in innumerable unhappy marriages. But the present-day wisdom, based on a better knowledge of the art of love, teaches the modern wife not to yield herself except as a matter of mutual self-expression, mutual desire, mutual culmination and satisfaction.

We have previously referred to the element of psychic resistance, sometimes more or less unconscious, so often found in the inexperienced bride. But this is by no means confined to the newly married. Indeed, it is a factor that sometimes grows with the years. If, as so often has been said, "The course of true love never runs smooth," this applies with added force to married life. Many psychological obstructions arise from time to time to interfere with satisfactory sex life. In the beginning these have to do largely with various mental reservations and inhibitions dating back to early impressions, often some lingering childhood repugnance to sex, all of which have much to do with the young wife's inability to relax and respond. It is helpful if she understands the nature of these obstructions.

Sex being not merely a physical relationship but a manifestation of all the psychic and nervous forces of the couple concerned, when the spiritual aspects of the relationship are disturbed the whole situation is changed. This is true especially of women of refinement. In this connection it should be said that the fear of pregnancy often acts as a powerful inhibiting force. This phase is discussed elsewhere. All such mental factors are to be considered in connection with any problem of sexual maladjustment in marriage at any time.

Many husbands, however, evidently fail to realize the importance and influence of physical factors of attraction. They are oblivious of the fact that their complete neglect in the matter of keeping fit and personal appearance means bodily deterioration in a variety of ways. Many modern wives make it a point to keep themselves at their

correct youthful weight, and to maintain the firm, trim quality of their bodies, but their husbands too often are quite satisfied to allow themselves to become soft and decrepit, and as a result, to lose their attractiveness and physical appeal.

Important Points in Marital Relations.—Here must be recalled what has already been said, namely, that the marriage relation is not a mere physical manifestation, but essentially a nervous and psychic experience depending upon the building up and accumulation of a type of nervous tension which continues stronger and stronger until the climax and release of this nervous tension brings relaxation, with mental and emotional peace. That is why haste on the part of the husband defeats its own end, at least insofar as mutual consummation is concerned.

"Prematurity" in Husbands in the marital relation is most important. The lack of "timing" is responsible for a host of sex-starved wives. Whatever the number may be (and the percentage of neurotics among married women suggests that it is considerable), the reason for the failure of the true consummation of marriage on the feminine side is due to this, the lack of synchronizing in the reaching of that climax which brings release of tension, and thereby constitutes the natural and supreme tonic for the nerves.

That is why haste on the part of the husband, as an expression of his selfishness, is likely to bring complete unsatisfaction to the wife. The masculine make-up seems to be naturally geared for quicker culmination than is the feminine organism. There are, of course, many exceptions but for the most part this is a sweeping truth, so much so that countless wives easily come to believe that their husbands are afflicted with the form of weakness known as "prematurity," when they may really be fairly normal. The significance of this fact, however, lies in the necessity for enough time in courtship and preparation in the initial stages of sex approach to insure sufficient eagerness on the part of the wife. Even then, because of the sensitiveness of the husband to stimuli and quick culmination, there may still be a strong likelihood that for him the climax will be reached before his wife is fully aroused. This fact makes it imperative that he should wait until she is not only responsive but eager and even then, if he is adept in the art of love, he will intentionally postpone the climax on his own part, until she herself arrives at the orgasm.

Where this matter of masculine oversensitiveness and too rapid culmination is concerned, however, it is only fair to explain that where

men are concerned there is really more to it than the mere development and release of nervous tension. The complicating factor here is the organic basis of ejaculation, namely, the pressure of the distended seminal vesicles. There is here, in short, a certain element of the occasional need of relief, a form of pressure due to the presence of the seminal fluid which has a marked relationship to sexual provocativeness. This pressure, if we may call it that, becomes more pronounced with the lapse of time. In case of absence or other form of denial, resulting in seminal accumulations, this very organic urge toward expression becomes more acute, producing a greater sensitiveness which may result in a temporary prematurity. As a very practical consideration in such cases, it is known that when a married couple indulge again within a comparatively short time, this difficulty is not met with.

This naturally brings up the subject of frequency in the marital relation, and to the concomitant question as to what is excess. On these points no general rule can be laid down, for individual capacity varies widely. Just as one man may be able to run a five-mile race, while another is exhausted by running a quarter of a mile, so what may be normal sex life for one person may be excess for another. And yet, such is the adaptability of Nature, that regular exercise of any function, short of excess, tends to improve it. Even the runner will go "stale"—a form of nervous depletion—through too much running. Sex excess is weakening, particularly to men, but short of such excess some regularity in the marriage relation not only is beneficial in a constitutional and nervous sense, but improves one's sexual condition.

However, there are great variations in different people. There are those for whom greater frequency than once a week would be excess. Others, more robustly constituted, may be able to indulge more often with impunity. This is, of course, a matter in which men are chiefly concerned, because of the drain of the vital and highly concentrated seminal fluid in too-frequent sex activity.

Women suffer no such losses, the phenomenon in the case of the wife being largely in the nature of a psychic and nervous experience, and if successfully culminated the effect will not, for her, be weakening even though practiced very frequently. In short, in a highly sexed woman achieving full satisfaction, there is practically no particular limitation. Of course, if she is merely aroused but ungratified, her nervous system and her health will suffer seriously, but that is another matter. So the question of excess is one in which husbands are mostly concerned. And while, as has been said, it is by nature the prerogative

of the wife to intimate her desire in this respect she should naturally not do so with such frequency as to be detrimental to her husband. No woman would want to do that to the man she loves, if she loves what his welfare requires.

The age factor is also of great importance, since what may be normal in young adult life may constitute excess in later life. In the forties and fifties, and especially beyond these periods, any greater frequency than once a week or even twice a month, may be too much. Of course, individual differences still apply at these more mature ages, but it is here increasingly important to avoid excess. Yet it must be remembered that the natural law of the maintenance of a function as being dependent upon its continued exercise still holds good in these later years. On the other hand, it is also true that complete neglect or disuse of a function leads to its deterioration or loss. This is not said for the purpose of influencing any special course of conduct for those of mature years, but merely as stating a truth recognized generally by the medical profession. This suggests, therefore, the expedient of a temperate, moderate middle course with the passing of the years, as most conducive to health and personal efficiency.

Now as to the feminine aspect of the matter during these later years. It has been too generally assumed that woman's sex life is limited to the child-bearing period, the period between puberty and the menopause, and that, after the change of life, so-called sex life for her becomes a closed book. It sometimes happens that those who have never had children may arrive at the menopause earlier, and, too, the woman who has never experienced sexual desire during the prime of life is hardly likely to develop youthful passion after the "change."

Those, however, who have been normal in their married life need not cease to be wives after they can no longer be mothers. Where the sex life is both regular and successful in the case of the wife it becomes established as a physiological habit, a well-conditioned nervous response, and in such cases it continues after the menopause. In short, in any really successful marriage the menopause does not mean the end of sexual life. One, therefore, need not worry about the future in this connection.

Another question that frequently arises is as to whether or not the sex relation may with safety be indulged in during pregnancy. This has been the subject of considerable difference of opinion. If one accepts the rule as followed among the lower animals no further intimacies are to be permitted after pregnancy is established. On the

other hand, the periodicity of desire in the lower animals is not at all paralleled in the human race, and this holds true also during pregnancy. If the opinion and the experience of gynecologists are to be considered, there is no reason why a moderate continuation of the marriage relation during pregnancy should be denied, at least in the early months.

Specialists in this field are practically unanimous on this topic. Some of us still have doubts on this point, but nearly all medical authorities agree that no harm is done by a moderate sex life after conception has occurred, although more and more care should be used as time goes on, and complete abstinence observed for the last two or three months. Any roughness or carelessness may precipitate a premature birth, and this possibility should be always kept in mind.

Sexual "Frigidity."—Sex responsiveness concerns not only one individual, but two persons, and its solution depends sometimes upon both. It is in the nature of a reaction to the appeal of another. Sometimes the deficiency lies in the character of that appeal. Again, the fault may be found in the incapacity to react. It is this incapacity that really constitutes true frigidity.

Among married women estimates of the proportion of frigidity run from 10 per cent. upward. But that tells us nothing about the unsuspected prevalence of this condition among "bachelor girls." Nearly one-third of the women of marriageable age are unmarried. Of course, many of these, especially under twenty-five years of age, will marry later, and others are widows. It is, however, quite probable that the lack of sexual responsiveness or a serious degree of what we call frigidity is the cause of their failure to marry—or rather their disinclination to marry.

A large proportion of married women never experience normal satisfaction in the marriage relation, or more specifically, never achieve the climax or orgasm which then brings release of nervous tension. But this does not mean that all of these women are cold or frigid. Naturally, some of them are. Many others are possessed of ardent natures, pronounced sex sensibilities and abundant desire, but in spite of this they still do not reach the consummation of the sex relation. In such cases the fault lies usually with the husband. These women suffer far more than the frigid types who have never had their sensibilities awakened. The nervous tension aroused by sex excitement is unrelieved, and the results are devastating. The frigid woman has no such difficulty and may therefore enjoy relatively good nervous health. She may be an ideal mother and—in all other respects—a perfectly

normal wife. But the fact that she is passive in the sex relation has its effects.

In the nature of things, frigidity in the wife plays a rather different part in the scheme of marriage than does impotence in the husband. The latter makes the consummation of marriage an impossibility. Not so frigidity, for the sex relation is still possible even though the wife plays a passive rôle. This, however, is not true marriage.

A woman may have been married for years and may be the mother of several children, and yet in the sense of any actual sex experience of her own she is still a novice. Emotionally she is untouched. Her sex sensibilities have never been awakened. She has yielded to her husband but in the absence of feeling she has known no real sex experience.

Since not more than a fraction of 1 per cent. of women may be said to be essentially and totally frigid through some congenital defect, it is clear that this abnormal state—except in a few of these cases—is usually curable under proper conditions. Indeed, this has been proven in innumerable instances, often as the result of the intelligent cooperation of both husband and wife, since the husband has much to do with his wife's condition. There are many instances in which this difficulty is due to the fact that a woman has married the wrong man. The pair may have been thrown together a great deal and imagined they wished to marry. From an economic standpoint, too, it may have seemed necessary to the girl. The couple may have been socially congenial, only to find after marriage that they were not sexually mated. Such things happen; indeed, they happen frequently. The wife is frigid because the husband does not have any appeal for her.

First of all, as a foundation for the psychological improvement needed, robust womanly health is imperative. This is comparatively easy; it is simply a matter of choice, and the working out of a program or scheme of living that will inevitably build vitality. Details are unnecessary here, as this matter is discussed in Vol. II, Part 4, and elsewhere in this work. When good health is assured with it will come womanhood and the instincts of femininity.

It may also be said that many cases of masculine impotence are likewise almost wholly psychological in nature and have their origin in exactly the same type of childhood experience. Of course, excitement and embarrassment on the part of the bridegroom may have a considerable influence, but even these emotions are largely the outgrowth of the underlying childhood associations of shame and indecency attached to the human body and to the generative organs in

particular, as a result of perpetual suggestions and injunctions in this respect. And so in many instances it takes time for the husband to orient himself and get back to a normal basis in marriage, so that he too may *learn* the art of love.

Birth Control and Health.—"Voluntary parenthood" is a much more representative and significant term to apply to what is called birth control.

Opponents of birth control have tried to distort its meaning by calling it "race suicide." But that is not a true synonym. Birth control does not mean race suicide. Instead it readily may be made the means of race improvement for there are family strains that would better be limited or discontinued, families heavily marked by insanity, criminal tendencies, feeble-mindedness, epilepsy, transmissible diseases, narcotic addiction or other evidence of a neuropathic make-up, and while some of these conditions may be subject to correction by right living, it is naturally true that other families altogether free from these weaknesses and defects are better stock from which to breed the future human race.

Because of humanitarian principles we take tender care of the weaklings and the unfit, and they survive to reproduce themselves, whereas in man's early evolution the strong and capable were the ones who tended to survive. Race-improvement occurs through raising the level of the average by selection of the stronger and better types. Civilization tends to counterbalance this process by aiding in the survival of the weaker and even defective strains.

And here the possibilities of birth control enter the picture. It has been well said that birth control is a two-edged sword, capable of cutting both ways, that is, in the direction of further progress or of that deterioration which seems to follow as a natural result of civilization.

If birth control means either childlessness or strict limitation of children among the intellectual and talented classes, but large families among the ignorant, the feeble-minded and the criminal classes, then the level of the human race will decline.

But if the poor and ignorant classes—who cannot afford large families—are allowed full information as to birth control, and the intelligent classes are willing to have average families of perhaps three or four children each, then it is possible that birth control will raise the level of the human race.

It is, obviously, useless to discuss this subject from the standpoint of population and the patriotic duty of giving children to one's country,

because the individual will insist upon looking at it from a purely personal viewpoint. And from this standpoint the modern woman declines to be put in the position of a mere breeder, expected to bear children to the limit of her physical capacity. Instead of having one baby after another, the modern woman feels that she is doing well if she has three or four babies. And that is by no means race suicide.

It is true that birth control would often mean a one-child family, and sometimes no children at all. This, in the case of healthy and capable couples, would be a misfortune. Marriage is never wholly complete without children. Babies add immeasurably to the interests and attractions of a home. They establish a stronger and deeper bond between a couple. If birth control were to mean no children at all, it would be better if one knew nothing about it. But since it really means voluntary parenthood it gives us a self-controlled power over the destinies of the human race unknown in any former period of history.

There are not only financial circumstances under which it might be unwise for a couple to have babies, but, what is even a more serious consideration, there are often conditions of ill-health which make pregnancy and childbirth not only inadvisable but positively dangerous. Again and again mothers have been sacrificed through the vital drain of pregnancy and maternity under conditions of serious ill-health. Womén should bear children only when in good health. Birth control would make possible the fulfilment of this requirement. Pregnancy jeopardizing the life of the woman too often leads to legally or illegally induced abortion. Birth control obviates recourse to this extremity.

We have already noted the very vital importance of normal sex responsiveness and of complete feminine consummation of the marriage relation, as the basis of nervous stability and feminine health in general. We have also spoken of the psychic factors that inhibit such responses. But among these there is nothing more frequent or more paralyzing than the fear of pregnancy in those who have no means or knowledge of birth control. For countless thousands this very fear of the consequences has spoiled the marriage relation and made it unwelcome and unnatural. And by making the sex union unsatisfactory it has prevented the possibility of happiness in marriage. This is really a minor consideration in the big question of birth control, which is concerned with the giving or withholding of life itself, yet even this phase of the matter, in the absence of the larger aspect, would have a

tremendous influence upon successful marriage. Yet not having children for those who desire them, whether due to sterility or birth control, is a major source of unhappiness in marriage. If a man desires children the wife's refusal to have any will place an almost insuperable barrier between them and the complete happiness which they might attain. This is one of those questions which should be thoroughly discussed before marriage, and a clear understanding arrived at.

In this country the practice of birth control on the dissemination of birth control information except by physicians under certain conditions is illegal. These laws are rather difficult to enforce, it would appear, for the drop in our birth-rate would seem to prove that where there is a will there is a way. Indeed, birth control information seems apparently to be very general except among the less enlightened classes.

Birth control, or voluntary parenthood, is to some extent an expression of woman's demand for freedom. It has been considered by some as a part of feminine emancipation.

It has been objected that birth control measures are usually not entirely dependable. That is undoubtedly true. Yet believers in the advisability of properly regulated birth control prefer an undependable method rather than a sequence of pregnancies which has so exhausted a mother that she gives birth to defectives, weaklings, or still-births, or persistently miscarries. If there are special reasons in the way of ill-health or prohibitive family traits that make parenthood totally undesirable, then even such "undependable" methods of birth control might prevent a very high per cent. of criminally induced abortions. Abortion is, of course, rightly termed a criminal procedure. Illegally induced abortion is a form of murder. Indeed, one of the strongest arguments in favor of birth control through contraception is that it tends to do away with criminal abortion.

There is another very popular argument against birth control in the assertion that contraceptive measures are antagonistic to health. Now, that may or may not be true, according to the method used. Indeed, in certain types of women lack of contraception may be truly damaging to health, as when pregnancy occurs in the woman whose state of health does not rightly permit it, or when the fear of pregnancy sets up psychic inhibitions which prevent normal sex responsiveness and climax. It is probably true that birth control has improved the health of countless women just because it has made it possible for them to enjoy a normal rather than an unnatural sex life.

However, there is reason for strong objection to one form of

attempted birth control, technically known as *coitus interruptus,* for this, apart from being distinctly undependable, flagrantly outrages the whole course of Nature. It may be harmful to the husband, and where the wife is concerned it is no less damaging.

The celebrated Dutch gynecologist Dr. Van de Velde has stated that "there is no ideal method of birth control; there never will be." He is probably right, because while a certain method may be highly successful in a vast majority of cases there will still be various cases in which it fails.

By taking advantage of the offer of Nature in establishing an infertile period in the monthly cycle, one can be fairly sure of desired results in the majority of cases with no disturbance in the indulgence of satisfactory normal sexual relations, and at the same time one will be practicing a truly "natural" method which is not only harmless but eminently satisfactory.

Fertile and Infertile Periods.—Long ago, attempts to attain birth control by recognizing definite periods as fertile, developed measures such as those advocated by the Capellman theory, placing the period of fertility "during the first fourteen days after menstruation and the three or four days before the next menstruation." Points of view diametrically opposed to this are advocated by modern scientific investigators.

Modern investigators also stamp as incorrect some guesswork prevalent in earlier periods as to the period the spermatozoa and ovum retain life. They estimate that the ovum is fertile to impregnation by the spermatozoa for twenty-four hours or more after the ovum passes from the ovary. Authorities, in the main, agree that the spermatozoa retain power to impregnate for at least two full days.

FERTILE AND INFERTILE PERIODS

The figure 1 shows the first day of the menstrual cycle. Non-fertile days in shaded type, fertile period in solid type. The fertile days should normally repeat monthly, the same number of days after menstruation. Charts have no relation to ordinary calendars.

(Based on 28 day Menstrual Cycle.)

1	2	3	4	5	6	7
8	9	**10**	**11**	**12**	**13**	**14**
15	**16**	**17**	18	19	20	21
22	23	24	25	26	27	28

The Rhythm Principle of Birth Control.—A theory which has the corroboration of scientists and investigators is that promulgated by Dr. Hermann Knaus, Director of the University Women's Clinic at Gratz, Austria, and Dr. Kyusaku Ogino, an outstanding gynecologist of Japan. The major conclusions arrived at by both of these physicians are practically identical. According to these joint conclusions ovulation occurs from 12 to 16 days before the subsequent menstrual flow.

Determining the Fertile Period.—On the preceding page will be found a simple guide to fertile and infertile periods based on the theories of Drs. Knaus and Ogino. Menstruation (for purposes of illustration) is indicated by the figure 1 as supposedly beginning the first day of the month. For each day later that it actually begins, the fertile period may be placed as one day later. The days included in the supposed infertile periods are indicated by open-face figures, the period accepted as fertile appear in solid black figures. Chart includes days before and after sterile period, providing for one day of life for the ovum, and two days of life in the spermatozoa.

In the cases of those women who may be regular in menstruation, but who menstruate every 25 or 26 days or every 29 or 30 days, the calculation follows the same method. If menstruation takes place at less than a 28-day interval, one counts one day earlier for every day less than the 28 days; or if menstruation occurs later than every 28 days, one counts one day later for every day over the 28 days. So that if a woman menstruates every 25 days instead of every 28 days her fertile period will be from and including the 7th day from the beginning of menstruation to and including the 14th day.

The importance of knowing as nearly as possible the number of days after ovulation that menstruation occurs cannot be overestimated, because in figuring the fertile and infertile periods in the menstrual month one must be governed by the time of the occurrence of menstruation; the occurrence of ovulation can be foretold.

This "rhythm" method of birth control has been so-called because of the reappearance of a fertile period at a definite time each month with the infertile periods recurring on definite dates also. In its practice accuracy is imperatively necessary. A written record must be kept of the dates at which each menstrual period begins and ends. Such a record should cover from 8 to 12 months, else it is unwise to depend upon the rhythm method as a safe means of birth control.

Sex Education for Matrimony.—Adults as well as children must become fully awakened to the truth that sex is not essentially

unclean. The knowledge of the physical facts concerning the anatomy and processes of reproduction is very far from true sex education so long as the personal and emotional attitude toward those facts is still dominated by persistence of the spiritually poisonous traditions.

There has been in recent years a very widespread "revolt of youth," in which the new generation has determined to face more frankly and honestly the facts of life and sex. In this "revolt," the youngsters have naturally blundered, largely, however, from lack of a clear understanding of sex ethics. It should be a part of any adequate system of education to clarify the ethical factors in sex conduct.

The foundations for a system of sex ethics will be found in the basic factors of responsibility and fair play, in short, the Golden Rule applied to sex. In human society this factor of responsibility has been crystallized into what we call marriage. It is the design of marriage to fasten upon the father the responsibility for the care of his children, and to insure to him, in return, that the children he provides for are his own children. Extra-marital activity is unethical and unacceptable because it does not recognize these responsibilities and obligations. Again, the monogamic basis of modern marriage rests upon a highly developed romantic impulse which forbids the sharing of one's mate. The Golden Rule is expressed here in the formula, "Be faithful to her as you would have her faithful to you. Go to her clean as you would have her come to you."

Manifestly, sex education must include the biological facts, but it must also include the fostering of a wholesome and clean-minded attitude. Sex education should include also knowledge of the requirements of courtship and the conduct of marriage, because it is of the greatest importance to be able to consider beforehand whether the marriage will be ideal or whether there exists any obstacles to interfere with future happiness. If such obstacles exist and if they are deemed unsurmountable one should certainly hesitate to enter the marriage relation.

Avoiding Childbirth.—One of the subjects uppermost in the mind of the average modern woman upon contracting marriage is the question of the possibility or method of avoiding children. The theory that a woman loses her figure through childbirth is absurd, as is evidenced by the experiences of many physical culture women who have had a generous number of children and preserved their beauty unaltered. And everywhere there is evidence that sterility is no guarantee of the retention of physical comeliness. How many times have

we not, each one of us, observed the lack of figure and of beauty in "bachelor maidens," and in married women who have avoided children? The women themselves know only too well the sagging, drooping state of their breasts, even though these have never served their intended purpose, and the flaccid, protruding aspect of their abdomens, when uncorseted. Motherhood is not to blame in such cases surely, and when those who actually have been mothers display the same deficiencies, it is not because of motherhood, but because of the other degenerate conditions which have robbed them of their physical soundness and vigor, whether married or not.

Children are desirable, therefore, in all cases where the parents are sound and normal, for the sake of the continued youth, beauty and health of the mother, and for the happiness and success of the home itself. Sterility is not to be desired by any normal woman. But at the same time, it is conceivable that a woman may desire to place some limit upon the size of her family, short of the extreme number of children which marks the extent of her physical capability.

Criminal Abortion.—While civilized women are greatly shocked, or pretend to be shocked, at the custom attributed to certain savage tribes of killing some of their infants, defective offspring only, in some cases, female offspring chiefly, in other quarters, yet the savages might be equally shocked and alarmed if they knew of the widespread practice of prenatal child murder among the supposedly refined women of our own localities.

Beyond question this crime against the unborn and against self is committed everywhere in civilized society, most frequently among the rich, but in later times quite often also among the poor. It is pointed to by some writers as one deplorable result of the legislation which prohibits information regarding the prevention of conception, but while this is only one interesting phase of the subject, the real cause of this terrible practice lies far deeper, namely, in the perversion of natural instinct which leads a woman to desire to avoid children even after she is already a mother.

To speak frankly, the fact that the child is not yet born does not make her any the less its mother. The fact that it is not yet fully developed does not make it any the less a human being. Many women endeavor to excuse themselves upon the theory that the child, only forming, is not yet a child, but a glance at the illustrations in this volume, showing the development of the fetus, will show very clearly that the little one is alive from the very beginning, and even at the

age of one month after conception is rapidly developing into the form and character of a child. Let women look about them at splendid sons and daughters grown, or at brothers and sisters whom they love, and then realize that it is actually such as these whom they are destroying. Murder is none the less murder because the victim is unborn and unseen.

Furthermore, there is nothing so destructive to the organism of the individual as the shock to the system involved in this outrageous and unnatural act. In many cases it produces the result of making it impossible for the perpetrator of the crime ever again to have children, when she may really want them.

Separate Beds.—The time honored custom of a single marriage bed is one great factor antagonistic to a normal married life. In many cases it will even be better to occupy separate rooms, each maintaining that element of privacy that is so conducive to mutual respect, and to self-respect, but which is usually lost after marriage. It may seem difficult to live up to the principles which we are teaching, and it may be necessary to fight long and hard for the necessary self-mastery, but the plan of separate beds will help in this, and only strengthen the attraction between the pair.

In short, the married couple should strive as nearly as possible to return to the wholesome conditions of courtship, the period which in the ordinary case is enjoyed as nothing in their later married lives can be enjoyed, except perhaps the joys of motherhood and fatherhood with a healthy, growing baby in the house. But the mutual relations of the couple, in themselves, in most cases never again approach the charm of that preliminary term.

Conditions Before Birth.—For the sake of having healthy, vigorous children, too much emphasis cannot be placed upon the importance of prenatal conditions. The health of the mother at this time is a matter of vital concern, inasmuch as the nutrition and development of the child depends entirely upon her condition. The blood of the mother not only serves to supply nourishment, but oxygen as well, at the same time carrying off the carbonic acid and other wastes incidental to the rapid growth and tissue changes of the embryo. All of this will be taken up in detail in a later chapter, dealing with pregnancy and motherhood, but there are some aspects of the subject which should be referred to here because of their relation to hereditary and other factors which determine the character and health of the new life before it is born.

The question of outdoor life and thorough ventilation is infinitely more important during gestation than at any other time, and we already know how vital it is at all times. Owing to the peculiar arrangement of the fetal circulation, which is made clear elsewhere by description and diagram, there is a considerable mixture of venous blood with the arterial blood supplied to parts of the body. In other words, even under the best circumstances, a great part of the body of the unborn child does not receive strictly pure and highly oxygenated blood. Therefore, if the mother breathes poor air and her own arterial blood is imperfectly charged with oxygen, the supply to the fetus is extremely unsatisfactory. In order that the most favorable development may proceed, the mother should breathe outdoor air at all times, or its equivalent in the house, so that she may carry in her arteries the greatest possible amount of oxygen. When in the house, ventilation which does not ventilate is not sufficient. The windows must be open, really getting the open air into the house, even if in winter it should be found necessary to spend an extra dollar for coal to keep the place comfortable with the windows open. This much, at least, one owes to the welfare and vitality of the unborn. Every woman, or at least every prospective mother, should thoroughly study and understand this matter, in order that she may realize the strict necessity for proper care in this respect. We need scarcely add here that this open air program will usually be sufficient in itself to relieve or enable one to avoid the nausea and other common annoying symptoms of pregnancy.

In view of the special importance of an abundant supply of oxygen at this time, we may the better see how reprehensible is the old-fashioned habit of remaining confined to the house, shrinking and unseen, for several months prior to the coming of the one who, after arrival, will be loved by the mother more dearly than life itself. We may see how criminal is that prudish and false sense of modesty which actuates the coming mother in remaining at home, and how damnable that prurient boldly staring, snickering and generally cheap and vulgar attitude of the public which causes the sensitive woman to shrink from exposure even when she herself is free from any impure or prudish views of her condition. But if she thinks of the welfare of the precious little life which it is her privilege to care for, she will throw aside all regard for such considerations, and will arrange somehow to be out-of-doors as much as possible and to have fresh air in her rooms at all times.

Another matter of special importance is the necessity for avoiding

alcohol and drugs of every description during pregnancy, this relating to and following upon what we have said about alcohol and other poisons before conception. Just as nutrition is supplied to the fetus, so may alcohol and other poisons pass into the fetal circulation with results far more disastrous than one could judge from observing the effects upon the adult organism. Just as alcohol is infinitely more injurious to the delicate, growing tissues of the infant or child than to the matured and better resisting structures of the grown up man or woman, so the results of alcohol upon the sensitive nerve and brain cells of the unborn, as well as upon the entire vital and functional organism, are destructive in the extreme. Physical deformity may thus result from arrested development or general disturbances of function, while various degrees of mental defect, ranging from slight mental incompetency to imbecility or idiocy, represent the appalling cost which one innocent individual may have to pay for the folly and sins of another. No one is more unfit for motherhood than the habitually drinking mother, and yet there are thousands of others who ignorantly add to the sum of the world's misfits and unfits through the use of "tonics," the chief stimulating factor in which is alcohol.

Other drugs and poisons act in the same way, being far more potent in harming the tissues of the unborn than to the increasingly resistant organism of any later time of life. Not merely should patent medicines be eschewed at this time, but all medicines of any kind, and if the physician is rash enough to prescribe his usual forms of medication, then at least those who have had the opportunity to read these and the foregoing pages will know better than to take them.

Maternal Impressions.—In discussing prenatal conditions, there will arise in nearly every mind the question as to the "marking" of the child, to use an old-fashioned term, or the possibility of stamping his mental or physical make-up with peculiarities, deformities or unusual tendencies because of the thoughts or experiences of the mother during gestation. On this point we are able to offer positive assurances of the immunity of the fetus from such influences, which will possibly lift a heavy burden from the minds of many women.

The theory of maternal impressions, or of "marking" the unborn, as commonly understood, is as old as was the one time theory that the earth was flat. And it was founded, in its early days, upon just as good logic as the conclusion that the world was a great flat expanse resting upon no one knew what. Countless thousands of mothers have lived through miserable periods of pregnancy, tormented and

crazed with their fears that through some small incident, some sight which they beheld, or some hideous word, they had "marked" their offspring with some ineradicable deformity or morbid tendency. Sleepless nights at a time when sleep is most required, interminable worry and depression at a time when happiness is most important because of its favorable influence upon the general health, have been the cost at which this superstition has been harbored even to this very day. Perhaps almost as much harm has been done by the fear of having ruined the child before its birth, as would have been accomplished if the theory were true.

In truth the only maternal impressions which are possible are those which affect the health, vitality and general physical welfare of the child. And the more we study these matters, the more we see the importance of the physical culture mode of life. For instance, we have already referred to the influence of alcohol, which is taken into the child's circulation just as is its oxygen and food. If the mother is poorly nourished and her blood deficient in the proper nutritive qualities, the child will suffer. If there are diseased conditions or disturbances in the organism of the mother, they may affect the child, but only because of and through this matter of the dependence of the latter upon the former for sustenance and elimination. In such ways maternal impressions are possible, affecting the physical welfare of the fetus, but not its temperament and inherited make-up. Mental gloom, worry or grief on the part of the mother will not directly affect the child's mind in the same way, but may cause such an impairment of the former's appetite and general health as to affect the nutrition of the latter. In this way only, do the thoughts of the mother affect the child.

It should be remembered that the embryo is the outgrowth of the single impregnated germ-cell, which contains within its chromatic material all of the factors and forces which will develop into a complete individual. Its constitution or temperament is already determined, needing only favorable conditions for its perfect development. Its potential qualities are all there in the germ-cell, and in the case of a bird it is only necessary to be supplied warmth and the nutrition stored up in the large egg. In the case of a human being, the nourishment is secured through the placenta from the blood of the mother. But here we should observe that, as the student will see later, the blood of the mother does not flow into and through the veins of the child as might be supposed by those uninformed. The blood in

the body and vessels of the fetus is its own blood which, flowing to and from the placenta, there passes so close to the blood of the mother, that particles of food and waste may be interchanged by passing through very fine membranes. Oxygen and carbonic acid are interchanged in the same way, but without any mixing of the two blood-streams. Poisons may enter the system of the child in this way the same as nutrition, but aside from this, and aside from disturbances of nutrition, oxygenation and elimination, the mother's thoughts and condition do not affect the child. Direct mental impressions, commonly thought to be so potent one way or another, cannot be made, for there is no connection of the nervous system of the one with that of the other. The child is as much a distinct individual a month or an hour before it is born as it is an hour after this critical event, except for the physical dependence referred to.

It is an open question as to just what extent a mother may influence the mental and physical characteristics of her offspring. While it may not be possible for the mother to directly influence the mind of the unborn child to such a degree as to adapt it to any particular training or walk of life, it seems unquestionable that the condition of the mother's mind during pregnancy has much to do with the mental qualifications of the unborn child. For instance, a mother who feels that by a study of works of art, of literature, or of music she can invest her unborn child with the ability in the particular sphere of art in which she is most interested, may not always be successful. Nevertheless, the betterment of her own mentality which must ensue through her attempts to thus attain improvement may perhaps favorably influence her little one's mental equipment.

It may be said that every one has heard of cases of "marking." We have all heard of them, but when we stop to think about it we note the fact that we have only heard of them, that we have not seen them among those whom we know, that they do not happen in our own families. The most careful investigations seem to show that the reported startling cases of this kind are sometimes merely coincidences, or that, as is more often, indeed, practically always the case, qualities thought to have been the result of prenatal influence are really the result of heredity.

The great lesson to be learned, therefore, is that the mother can favorably influence the health and vigor of her unborn child, that she may, by making the most of her own physical condition, add to its vitality of body and of mind. But if she has experienced a fright, or

has been suddenly shocked by the sight of a mutilated body or other horrible object, she can go on her way as she would in any other circumstances, trying to forget it for her own sake, and without any endless fears and sleepless nights of worry over the thought that she has so stamped her unborn. She may go on striving to be healthy and happy, assured that her baby, when it comes, will be normal.

Popular Fallacies.—There are some who claim that mental impressions are readily made upon the embryo by anything unusual in the mental condition of either parent at the critical time of conception, but this is extremely doubtful. For while a state of alcoholism, for instance, would be likely to cause permanent injury, for the reason already observed in referring to the destructive effect of this poison upon the germ-plasm, this is very different from saying that a special mental impression can be made in the manner supposed, when both are in a state of health and the relation a normal one.

The all-important question here, as everywhere in the consideration of the requirements of parenthood, is the question of health and vitality, so that the offspring will be as vigorous as possible, no matter how the temperament, talents and inclinations may be determined by the divisions of the various hereditary factors in the maternal and paternal germ-cells, and the special combination of these in their union as the embryonic cell.

Sex has been so little understood, and so little studied, that it is perhaps only natural that a vast amount of mysticism should have grown up around it.

Sex passion, for instance, has in some quarters been regarded as a deplorable factor in conception, being supposed to exert a mystic and sensual influence which will cause the offspring to be unusually erotic and licentious. Vicious habits and extremes of sensuality are instead to be attributed to the prudery which has, to a greater or less extent, poisoned the minds of practically all human beings born in civilized society. We are all usually born normal in this respect.

Sex passion is not in itself essentially or inherently evil. It is a perfectly natural and normal expression of the race instinct, the reproductive impulse, which has been made imperious and well-nigh irresistible in its nature and demands only because this is necessary to insure the perpetuation of life. There is nothing impure in this race instinct, but there may be immorality in the use which one may make of it, the perversion or abuse of it. Not that sex passion does not need restraint, for such restraint is one of the most vital requirements

of life. As a matter of fact, Nature herself has provided for a large measure of this restraint in the normal instincts of the female, which only need to be obeyed closely.

However, the habit of speaking of passion as one's animal nature, or lower nature, is no more justified than would be the practice of speaking of the appetite for food as one's animal nature. In a sense it is true in both instances, because a human being is fundamentally an animal and ought to be a good specimen of one. But that there is anything unnatural, or wicked, or vile, in the reproductive instinct is untrue. If one tells lies, this does not make the power of speech a thing of evil. The evil lies further back, in the mind of the offender, which directs the misuse of a high function. The sex instinct is the source of all that is sweet and beautiful in the love of a man and a woman, the vital force that draws them to each other and holds them together, and which, if not perverted, will provide for their lifelong happiness and appreciation of each other. Held in its proper place, its subtle influence will make even their mental companionship more interesting.

And while the expression of this passion should be guided by feminine instinct, and further restrained by intelligence, discretion and a refined sense of self-respect, it should be recognized that it will not under any circumstances give rise to abnormal qualities in the offspring. If the latter should develop such morbid propensities, and it can be clearly proven that they are not the result of vulgar associations and misguided education, then we may rest assured that they are the result of hereditary factors, and not due to the supposed "unrestrained brute nature" of the man at the time of conception. The real trouble in such cases is probably a lack of the inborn qualities which make for refinement, self-control and consideration of others. Let us see these things straight and understand the truth in regard to them. The reproductive instinct itself should not be vilified as a power intrinsically base.

How Is Sex Determined?—There has always been a great amount of speculation upon the question of the determination of sex. Again and again supposed *laws of sex* have been formulated only to be found as unreliable and untrue as those which had preceded them. More recent experiments, which have been tried out in a fairly large number of cases, would seem to indicate that the time of conception is the most important determining factor, but even this has not proven infallible. It must be remembered, however, that it is

very difficult to control absolutely the time of conception, and unless care is taken mistakes in keeping records are likely to occur.

The "time of conception" theory holds that a girl is likely to result if conception occurs within five days after menstruation and that a boy probably will result if conception occurs from the eighth to twelfth day after menstruation; or simply that a boy becomes increasingly more likely after the fifth day following menstruation.

This and other theories have been known to fail. Incidentally, it should be remembered by those who desire children, that conception may take place at any time during the fifteen days following menstruation, or the five days previous, thus leaving an interval of some eight days during which conception is less likely to occur.

Finally it seems that sex is really determined by a special factor in the chromatic material of the germ-cell. The ripening and division of the male germ-cell leaves an equal number of matured sperm-cells with and without a peculiar sex-determiner, so that the gender of the individual depends upon whether one or another of these happens to impregnate the ovum. The detail and method of this, and the part played by the sex factors in the female germ-cell, are technical.

Twins.—To the average reader the subject of twins is perhaps not so important as it is interesting. They are said to occur about once in a hundred and twenty cases, while triplets may arrive once in about eight thousand births. Quadruplets will probably happen two or three times in a million human births. If twins have occurred among your forebears then it is entirely possible or likely, if you have a large family of children, that you may have them at some time, for the tendency to produce twins seems to run in families.

Twins are the result usually of the ripening and discharge of two ova in one month, both of which are fecundated at or near the same time. Triplets and quadruplets arise in the same manner. It sometimes happens, however, that twins are produced from a single impregnated ovum as the result of the *fission* or division of the latter. When twins are produced by two fertilized ova, each fetus has its own placenta, amnion and chorion, while when they are the result of fission in a single fertilized ovum, they share one chorion and one placenta. About the only way in which the existence of twins can be recognized before birth is by the sound of the two separate fetal heart-beats, at different points.

The very startling and striking resemblances in twins of the same

sex, resemblances in disposition and mental tendencies as well as in appearance, are probably always the result of a common origin in a single embryonic cell, a case of fission, both having come from the same identical combination of hereditary determiners. When twins are of opposite sexes, it is clear that they are the result of the separate impregnation of two distinct ova. Sometimes, in the case of twins produced by fission, the process of division is incomplete, and the product is a pair who are grown together in some way or other, with more or less deformity. The so-called Siamese Twins, famous all over the world, and others who have been exhibited as museum freaks, were produced in this way.

PART 14

WOMAN'S SEX LIFE AND STRUCTURE

THE organs of generation in woman consist mainly of two ovaries which may be regarded as the parental germ-glands of the female, and in which the maternal germs, or ova, are secreted; the womb, or uterus, which is the organ of gestation, and which is designed to contain the embryo while it develops and until it is ready to enter upon its term of existence in the external world; the Fallopian tubes, a pair of ducts which connect the ovaries with the womb and serve periodically to carry the ripened ova to the latter; and lastly, the vagina, which serves as the birth canal, and connects the mouth or opening of the womb with the exterior.

The womb, called also the uterus, may be said to be similar to a flattened pear in shape, is situated in the cavity of the pelvis between the bladder and the rectum, being retained in its position by the round and broad ligaments, chiefly the latter. On each side of the womb, and projecting from the back of the broad ligament are the two ovaries, while the Fallopian tubes, running over the upper portion of the broad ligaments, form a loop, as it were, above and around the ovaries.

The ovaries, or germinal glands, are perhaps the most important part of the female generative system, since it is in them that the egg or ovum containing the germ of the new life is developed. The ovaries are analogous in function to the testes of the males. Their sizes and shape may be best understood by comparing them to an almond about one and a half inches long, three-quarters of an inch in width, and about one-third of an inch thick. They are of a grayish-pink color. Their exact normal position is the subject of some difference of opinion, but we may say that it varies according to the inclination of the uterus.

The outer structure of the ovaries is dense and firm, but contain soft fibrous tissue which is abundantly supplied with blood vessels. Embedded in this tissue are numerous vesicles called ovisacs, or Graafian follicles, in which the ova are contained and developed, the only sources from which human life can spring. The fluid contained

VERTICAL SECTION OF GENERATIVE ORGANS IN WOMAN

Greater omentum (fold of peritoneum.

Transverse colon (cross section).

Posterior layer of transverse mesocolon.

Duodenum.

Pancreas (tail portion).

Mesentery (fold of omentum connecting intestine with abdominal wall).

Small intestine.

8 and 9. Mesenteric folds of peritoneum.

10. Pouch of Douglas (recto-uterine fold of the peritoneum).

11. Uterus.

12. Peritoneum (vesico-uterine fold).

14. Bladder (with metal tractors).

15. Symphysis Pubis (pubic junction of pelvic-bones).

16. Vagina.

in the interior of these vesicles is transparent and albuminous. Each follicle contains a single ovum or egg, a tiny spherical body varying in size when matured from one one-hundred and twentieth of an inch in diameter down to sometimes half that size. In each ovary there are several hundred ova, or ovules, as they are sometimes called, in various stages of development.

Every healthy woman, during the possible child-bearing period of her life, matures and discharges an ovum once every twenty-eight days. The vesicle, sometime before the monthly flow, begins to germinate and swell, the ovum, which in its immature state is fixed to the wall of the ovisac or Graafian follicle, now becomes detached and moves near the free surface. Finally it bursts through its covering and springs forth, then passing through the Fallopian tube and into the womb.

The Fallopian tubes, or *oviducts,* two in number, are attached at each side of the upper body or larger end of the womb and extend outward to the ovaries. They are about four inches in length, and their general direction may be said to be outward, backward and downward. They are normally about one-eighth inch diameter, the canal through the center being small, and in the end adjacent to the womb being only large enough to admit a small bristle. This canal is a little larger toward its outward extremity, with a trumpet-shaped termination having a fringelike formation, termed fimbria. This end of the tube is not directly connected with the ovary, as with the womb at the other end, but during the period of generative excitement the fimbriated or fringed part appears to embrace the ovary. The ovum, when set free from the latter by the rupture of the Graafian follicle, is received by the fimbriated extremity and conveyed to the uterus. It is not known just how long it takes for the ovum to complete its passage through the tube, but it is thought by some authorities to take from three to five days. The object is to bring the ovum within the reach of the fecundating influence, and after it has been fertilized it is attached to the walls of the womb.

The Fallopian tubes are lined with a mucous membrane, being continuous with that of the womb, of which the tubes may be regarded as branches. Therefore, whenever there is inflammation in the cavity of the uterus, it is extremely liable to travel up the tubes, and even to the ovaries. The tubes under such circumstances become swollen and very painful, and because of their exceedingly small caliber, may sometimes become permanently closed. This not uncommonly hap-

pens as a result of gonorrheal infection which has extended to these parts, and in such a case the woman may become permanently sterile.

The womb, or uterus, is a hollow, muscular structure, having somewhat the shape of a pear, as we have seen, and being in the virgin about three inches long, two inches broad at the upper part, and perhaps one inch in thickness. It weighs from an ounce to an ounce and a half, though following maternity it may be a little larger. The ligaments which hold it in place consist of folds of the peritoneum, the membrane which lines the entire abdominal cavity. There are six ligaments thus provided, two in front, two behind and two at each side. In front, the two anterior ligaments connect the small lower part or neck of the womb with the posterior (rear) surface of the bladder. Behind, the posterior ligaments connect the uterus to the rectum, while at the sides the large lateral or so-called broad ligaments pass to the side walls of the pelvis, forming a partition across the latter, and dividing this cavity into a posterior part containing the rectum, and an anterior part containing the bladder, urethra and vagina. There is also a small utero-ovarian ligament on each side, between the womb and each ovary.

When in its normal position the upper and larger end of the womb is directed upward and forward, with its lower end or apex downward and backward, and projecting into the upper end of the vagina. The organ consists of three parts, so to speak, the *fundus, body* and *cervix,* the fundus really being the upper broad extremity of the body, which slopes down to a slight depression or constriction, known as the isthmus, below which is the small, narrow part known as the cervix, or neck, as it is often called. This cervix is partly in the vagina and contains the *os uteri,* or opening into the latter. The cavity of the womb is small in comparison with the bulk of its muscular walls, and in the upper part is triangular in form, corresponding with the general shape of the body.

The two upper corners of this triangular cavity take the form of funnels leading into the Fallopian tubes, which lead out from the fundus, as we already know. The lower corner leads through a constricted opening and into another small cavity of the cervix or neck. This internal doorway between the cavity of the cervix and of the body is the *os internum,* and the immediate external opening into the vagina is the *os externum,* or mouth of the womb. In a healthy state, this is so well closed as to be just perceptible.

The entire cavity of the organ is lined with mucous membrane,

though that of the body differs considerably from that of the cervix. In the latter there are many follicles and glands, globular and sac-like in form, raising the surface in conspicuous ridges, and secreting a transparent but firm and adhesive mucus designed to close up the neck of the womb during gestation and to guard against accidental disturbance or displacement of the egg.

The upper cavity—the womb or uterus proper—has a smooth and rosy-colored mucous membrane, with innumerable minute tubular follicles opening on its free surface. This mucous membrane lining the womb, it should be noted, is continuous with the mucous lining of the vagina, at the one end, and at the other, through that of the Fallopian tubes and its fimbriated extremity, with the peritoneum. It is for this reason that a disease or inflammation of the vagina or womb may readily extend so far as to cause peritonitis.

The womb has three coats, the internal or mucous coat being the mucous membrane which we have just considered, and which adheres closely to the muscular tissue. The middle coat is the muscular coat, forming the great bulk of the organ, the muscular tissue being arranged in three layers. The external or serous coat is formed by that part of the peritoneum surrounding the organ, and covers nearly all of it, excepting the portion of the cervix which projects into the vagina. The neck of the womb, when in a healthy state, is soft, smooth and of a pale rose color. It is elastic and pressure upon it produces no pain. The womb has a remarkable supply of blood-vessels, the arteries following a tortuous course and having frequent intercommunication. The veins are large and similar in arrangement. During the enlargement of the womb in pregnancy they are dilated and are termed uterine sinuses or canals. Through this remarkable network of blood-vessels is secured the profuse supply of blood from which, through the placenta and umbilical cord, the new life is nourished during the middle and later periods of its prenatal existence. During pregnancy the womb naturally enlarges and becomes more vascular, that is to say, more freely supplied with blood-vessels, attaining a weight of from one and a half pounds up to three pounds. After childbirth it contracts in the course of some six weeks' time to nearly its virgin size, though having a larger cavity and weighing from two to three ounces. During menstruation, and shortly after, the womb is also slightly enlarged and more vascular. In old age it becomes atrophied, more dense in structure and paler in color.

The *vagina* is a muscular, membranous canal connecting the womb

with the exterior, being somewhat constricted at its entrance and dilated at the uterine extremity. It is distensible, with a length of about two and a half inches along its anterior or forward wall and three and a half inches along the posterior wall. Its inner surface is characterized by folds of the mucous membrane, presenting many transverse ridges, these folds being most numerous near the vulval or external opening. There are also, in the virgin, two longitudinal ridges, called the columns of the vagina, one along the anterior wall and the other along the posterior wall, thus making the tube flattened from before backward. The vagina, aside from its purpose as the birth canal, is naturally the excretory duct for the uterine secretions. Beneath the mucous membrane the structure of the vagina is muscular in character, and these muscles help to give support to the womb. Since the normal position of the latter is a matter of much importance in connection with the health of every woman, one may well realize the importance of maintaining these vaginal muscles in a state of strength and vigor, which is only possible when the body generally is strong and well developed. The physically inactive woman is likely to suffer from female trouble in the exact proportion of her inactivity and lack of normal muscular energy.

The *external parts* of the female generative system are generally known under the name of *vulva* or *pudenda.* The rounded oval eminence situated immediately above the vulva, is the *pubes,* often called the Mount of Venus (mons veneris) which becomes covered with hair at the time of puberty. It is due to the prominence of the pubic bone, the forward portion of the os innominata. The large, outer lips of the vulva, enclosing the common urino-sexual opening, are the *labia majora.* Each lip (labium) has two surfaces, outer and inner. The outer surface is pigmented and covered with crisp hair, while the inner is smooth. These lips are thicker in front, forming the anterior commissure; posteriorly they merge into the posterior commissure. The space between the posterior commissure and the anus (rectum), about an inch in length, constitutes the *perineum.* The fourchette, a fold of membrane at the posterior junction of the labia majora, is also the anterior edge of the perineum. This perineum is sometimes subject to severe tears in childbirth, though the danger of this may usually be obviated by measures for building up the health, strength and elasticity of all tissues.

The *labia minora,* or nymphae, are a pair of smaller inner lips consisting of two small cutaneous folds within the labia majora, these

also enclosing the opening of the vagina. Anteriorly, the two labia minora meet and form the frenum of the clitoris.

The *clitoris* is an erectile structure similar to the corpora cavernosa of the penis in the male, its body being short and concealed beneath the labia. Its free extremity or so-called gland (glans clitoridis) is a small rounded tubercle of spongy, erectile tissue and highly sensitive. There is not infrequently a small fold of membrane at the end of the clitoris about which secretions may collect and cause nervous irritation, especially in the case ot young girls, if thorough cleanliness of the parts is not observed. The clitoris, like the penis, is provided with a suspensory ligament, and two small muscles, the erectores clitoridis. Between the clitoris and the entrance of the vagina, enclosed on each side by the labia minora, is a triangular, smooth surface known as the vestibule. It usually extends about one-half an inch below the clitoris.

The *urethra* is the small membranous canal leading from the neck of the bladder and having its opening in the floor of this vestibule, the urine passing out of the body through this channel. Below the orifice of the urethra is that of the vagina, more or less closed in the virgin by a membranous fold known as the hymen.

The *hymen* varies in shape and size with different individuals, and is sometimes entirely absent. It stretches across the lower part of the vaginal opening, often taking the form of a half moon, and sometimes the form of a ring, while in some instances it almost entirely covers the opening. After marriage it may persist in the form of notched folds. Much injustice and cruelty have resulted from the old habit of regarding the intact hymen as a test of virginity, for, as we now know, it offers no such authoritative evidence, just as its absence indicates nothing.

The truth is that the hymen may be ruptured by violent exercises, or may be destroyed by accidents, especially by falling astride some object. Horseback riding has been known to injure it. Operations and vaginal examinations may be the cause of its absence. On the other hand, the ruptured hymen may sometimes resume its original intact form, this having been proven to be the case with many widows, and even prostitutes have been known to retain the hymen unchanged. The hymen was so named after the ancient god of marriage, and because of the belief prevalent at that time that it was a true evidence of virginity.

Menstruation.—(See also Part 5.) Under normal conditions the menstrual flow, sometimes spoken of as "the monthly," occurs at inter-

vals of twenty-eight days, or once each lunar month. We have seen that once each twenty-eight days one germ-cell or egg (sometimes more than one) is ripened and discharged from the ovaries, being then carried to the womb, where, if fertilized by the sperm-cell, it may attach itself to the inner wall of this organ, securing the nutrition needed for its continuous growth. The ovum may retain its capacity for impregnation for some time after its escape from the ovary, but if not fecundated, loses its vitality after a time and is finally carried away with the uterine secretions.

During the swelling and bursting of the Graafian follicle which results in the discharge of the ovum, the vessels of the ovaries and womb, and particularly of the membrane lining of the womb, are so crowded with blood as to produce a state of congestion.

Although most authorities contend that menstruation is the result of the discharge of the ovum the two conditions are not always coincident. During pregnancy, the menstrual flow does not usually appear, though there are occasional exceptions to this rule. Similarly, all signs of menstruation are usually absent during the period of lactation or nursing and until the child is weaned. But so long as impregnation does not take place, there is each month an abundant secretion of mucus, mingled with blood, which is discharged, usually totalling in quantity from four to six ounces of liquid. The discharge of blood takes the form of a capillary hemorrhage, exuding from many fine points as a result of the stretching and weakening of the walls of the capillaries of the uterine mucous membranes, when so crowded with blood. Because of this fact, and of its mixing with a large amount of mucus, including the slightly acid mucus from the walls of the vagina, the menstrual flux does not coagulate, though clots may be formed when the discharge is very profuse. Minute particles of the membranous lining of the womb are also passed out. The duration of the flow varies according to the muscular tonicity, the general habits of living and even the climate. The flow may last from three to seven days, though usually about four, is rather dark in color at first, and gradually becomes paler. Anemic women and those in poor health often have a pale discharge. Women of dark complexions usually flow more than those of fair skins, while fleshy women commonly flow more than those who are thin.

The womb, during menstruation, is of a darker color than in the intervening periods, being also larger and heavier, because of the large amount of blood contained in it. For this reason it has a tendency to

fall downward or out of place if the woman is in poor health and the adjacent muscles and ligaments consequently weak. As we have seen, menstruation is a natural condition, intended to provide for the nutrition of the embryonic cell, and in a woman of normal health, strength and all-around bodily vigor, will cause no pain or trouble. In a state of weakness, however, very distressing symptoms often develop. Examined with a speculum, the parts are found red, sensitive and almost inflamed during menstruation, and if one is not vigorous the congestion may be so great as to give rise to pains in the ovaries and womb, often extending to the back, the groins and thighs, together with a general sense of heat, aching and dragging down in the lower part of the abdomen. These are sometimes accompanied by hot flashes, chilliness, and various nervous or hysterical symptoms. It is important that others in the household understand the meaning of these hysterical symptoms, when they occur. Sometimes there is a feeling of fulness and oppression in the head, with dark circles under the eyes, and perhaps an enlarged and painful or sensitive condition of the breasts. In some cases there may be nervous symptoms the day before, or even for several days previous to the coming of the event, with more or less irritability and lassitude.

It is sometimes thought that these are the penalties which one must pay for being a woman, but this conception shows an absolute misunderstanding of the entire scheme of Nature. These are the penalties which one must pay, not for being a woman, but for weakness, for the disregard and violation of those natural laws upon the observance of which we depend absolutely for our physical welfare and comfort.

When we consider that menstruation is repeated every four weeks, and that the congested or crowded state of the vessels begins some days before the monthly flow, and endures for perhaps ten days in all, or about one-third of each month, we need not wonder that, in the case of weak and unhealthy women, a condition of chronic inflammation should sometimes supervene, with all its attendant suffering. When we further consider the common use of tight clothing, high-heeled shoes, of supporters with their tight waist bands, and other abominations of women's fashionable dress, and add to this the lack of wholesome exercise, errors of diet, indoor life, late hours and the general carelessness in all matters of health, pain and discomfort are only natural results.

The menstrual flow is affected to a marked extent by the diet and method of living of the individual. It is reasonable to suppose that

the excessive flow which exists in some cases is a result of an attempt of the system to eliminate impurities resulting from the stimulation of artificial habits.

Care of the Body During Menstruation.—The matter of bathing and general cleanliness is a most important one, even more so at this time than at any other. The intelligent and up-to-date woman no longer has any sympathy with the antiquated notion that bathing at this time is a dangerous proceeding and to be avoided at all costs, even that of bodily unwholesomeness. The question of bathing with cold water at this time is one that may be determined only by the strength and resistance of the individual. There are some who can take and benefit by a cold bath each morning during the monthly period the same as at other times, while there are others who should under no circumstances attempt such a thing. This phase of the question is covered clearly in Part 5 of the present volume, and elsewhere in this work. In every case, however, sponge baths may be taken in a warm room, and the usual warm baths for purposes of cleanliness, while local washing may be practiced as frequently as necessary, preferably with each change of cloth, and using a mild antiseptic solution if the characteristic odor of the flow is sufficiently marked to make this desirable. This odor is more marked in some cases than in others, though in a thoroughly healthy woman it may scarcely be detected at all.

Linen napkins are usually preferable to cotton, inasmuch as they are more absorbent. They wear so much longer that they are probably just as economical.

Various sanitary pads are now on the market, containing a soft filling in scientifically prepared fiber gauze, that are very absorbent and hygienic. After use the pads may be snipped into three or four pieces and flushed in the toilet, or one may burn them. Always they should be scrupulously clean. In the case of napkins the process of ironing with a very hot iron serves fairly well as a means of sterilization. It is usually best to be provided with a light girdle with tabs to which to pin these pads, such a girdle being more elastic and satisfactory if cut upon the bias. Such sanitary protectors should not be worn too tight, for the pressure will cause heating, discomfort and general irritation of the parts. Uncleanliness at this time may sometimes give rise to inflammation of a more or less serious character.

If the coming of the menstrual period is attended by a lack of appetite, nervous symptoms or other disturbances, it is often well to

fast either for one or two meals, or for one or two days, at the same time drinking plenty of water. The beneficial influence of a fast under these circumstances is truly remarkable in most instances, the general reasons for which the reader can only appreciate by a reference to the discussion of the therapeutic aspects of fasting as given in Volume II. Where there is pain, the application of heat is usually invaluable, applied either through fomentations or hot sitz-baths, while the drinking of hot water may likewise bring relief. The condition of the bowels, however, is a matter of extreme importance. Since, as we have seen, the womb is placed directly between the bladder, in front, and the rectum, in the rear, a condition of constipation will cause such pressure as greatly to aggravate all of the symptoms, or, in some instances, to cause a state of inflammation and general disturbance that would be imperceptible if the colon were properly emptied. An enema may be recommended just previous to menstruation and even during same, if there is any doubt that the bowels have been sufficiently active. And a hot enema, by the way, is one of the most perfect means of applying heat to the womb in case of inflammation and pain.

The common injunction to avoid standing for long periods at this time may be of especial value in the case of one who has never taken up measures for strengthening and building up her body. Because of the increased size and weight of the womb at this time, the weak woman will naturally experience a dragging down sensation, expressing the tendency to prolapsus, or falling down of the parts. If the muscles and ligaments are strong, this cannot happen, and she will not experience the general condition of strain and the nerve irritation from which she will otherwise suffer. It is all such an exceedingly simple matter, and yet one of such importance as far as the comfort and welfare of the woman is concerned, that on this account alone she cannot afford to neglect her physical health. If intelligent, she will not fail to adopt every possible physical culture measure for strengthening and perfecting every part of her body.

Cleanliness at other times is likewise a matter of importance, but in this one should be concerned more with the external parts than with the internal organs. In ordinary circumstances the internal parts may be trusted to take care of themselves, and the woman who enjoys pure blood and vigorous health need never give them a thought. There are those who advise a daily vaginal douche with some antiseptic solution for every woman, but it is truly an exceptional case that

will require this. The acid secretions of the vagina are themselves of a mildly antiseptic nature, so that the organ is really self-cleansing, in the case of the average healthy girl. Certainly the healthy and vigorous girl need not consider the question of douches, unless there is special occasion.

When used the douche should be warm, or of about the temperature of the body (98° F.) if one has no bath thermometer to determine its exact temperature, or a little warmer, from 100 to 105 degrees, if desired. Since the douche is desired only for cleansing purposes, the warm water will be much more effective than cold, and it is best to use that which has been previously boiled. The use of a mild antiseptic in the douche is a matter to be determined by individual needs. A solution of boric acid may be employed in this way. Unwholesome vaginal discharges indicate a condition in which frequent douches will be of advantage.

The external genitals, however, require strict daily attention in order that they may be kept wholesome. They should be sponged or washed each day with absolute thoroughness, paying special attention to the folds of the labia. These parts are kept moist by the secretion of a lubricating material, but offensive accumulations will result if they are not kept clean. Carelessness in this regard is almost unpardonable. Not only should one remember that uncleanliness in this connection may result in irritation and inflammation, but also that strict cleanliness and wholesomeness of every part will be found to be a tremendous factor in directly aiding one in maintaining one's self-respect.

The suspension of menstruation is generally regarded as one of the first signs of pregnancy, though, as explained later, there are exceptions to the rule, and the flow may appear once or twice subsequently to conception. There have even been rare cases in which it has continued regularly after conception. Such a condition almost always indicates an abnormal or unhealthful physical condition.

Now, impregnation is much more likely to take place, as we have already seen, immediately before or after menstruation than at any intermediate period. There have been instances in which an apparent condition of sterility has been overcome by taking note of this fact. The general attitude of the female generative organs during coition is largely passive, though under the influence of sexual excitement there is a considerable degree of inflation in the erectile tissue surrounding the vagina, together with an increased secretion from various glandular follicles. It appears, however, that conception may take place

regardless of these changes, even in profound sleep or narcotism. It is supposed by some authorities that the os uteri dilates by a kind of reflex action to receive the semen, though this is doubtful. The mere introduction of a small quantity of the seminal fluid just within the vagina or even the labia may be all that is necessary to bring about conception, the spermatozoa being extremely active in making their way to the womb.

The Period of Puberty, or inception of ability of the female to procreate, in temperate climates, is usually between the thirteenth and sixteenth years. From the standpoint of time, the reproductive power is more limited in women than in men, usually terminating at about the forty-sixth year. Puberty consists in the development or maturing of the sexual organs, which, as a rule, takes place at an earlier age in warm climates than in those that are temperate or cold. The average age in temperate zones is fourteen years, while in tropical or nearly tropical countries the change may occur as early as the tenth or eleventh year. In our northern climate, it may be hastened by conditions of social life, and unwholesome associations or amusements. Sexual precocity of this sort has a truly pernicious influence upon the physical development and nervous system of young girls, and every effort should be made to keep them rather in the open air and engaged in active play. It is greatly to one's disadvantage to arouse this function earlier than would naturally be the case.

The signs of approaching puberty are the growth of hair on the pubes and other parts of the body, the enlargement of the mammary glands or breasts, the broadening of the pelvis and hips to make room for the development of the generative organs, together with a general increase in the roundness, fulness and grace of the entire body. There are often mental changes of a noticeable kind, including a more retiring disposition and a more serious general mental attitude. As a rule the first appearance of menstruation is preceded by a general disturbance of the system, including such symptoms as sleepiness, sluggishness of mind, headaches, dizziness, a sense of fatigue in the lower extremities and perhaps pains in the loins. In the first instance the full menstrual flow may not assert itself, there being presented only a moderate discharge of mucus and very little blood. This need occasion no alarm, however, for subsequent periods will without doubt bring forth the normal menstrual flux. It should also be said here, that the interruption of the function in young girls should not cause alarm, for in some cases there are intervals of several months in which

there are no signs of the phenomena. Every effort should be made to assure the best general health, with no late hours, dissipation or waste of vitality, and Nature will take care of her processes in the most perfect manner. Sometimes there are changes and developments going on which occasion these lapses of time between the menses during the first one or two years of their occurrence, and one need feel no concern regarding them, especially when the apparent absence of the function does not cause inconvenience or ill-health. But the sudden stoppage of the flow after it has begun, through a severe chill or other disturbance, will sometimes give rise to difficulties.

A vast amount of energy is required by the changes taking place in a girl's body during the period of puberty, and for this reason it is especially important that she should take good care of herself, especially to avoid all forms of nervous strain. Unfortunately, most girls just at this delicate period are subjected to the very greatest mental strain in their school life, being crowded with studies and duties almost innumerable. In some cases, this demand upon the strength of the little potential future mother is nothing short of criminal in nature, and in a vast number of instances it would be best if she were taken out of school entirely for two or three years, or until her body has entirely developed and she can spare the energy necessary to keep up with the strain imposed by our exacting and overburdensome curriculums.

It is sometimes said that a girl should not be subjected to any marked physical exertion during this period, but this advice is rather misleading in many cases inasmuch as it may deter one from the practice of wholesome outdoor games and exercises. It is true that the girl should have as much rest as she needs, and especially as much sleep as she can get, and that overstrenuous exercise is not desirable. But let the young girl at this age, more than at any other time, keep up her girlhood sports and open-air games. Remember that the necessary rest should be chiefly concerned with relief from all forms of nerve strain, rather than the cessation of physical activity. The physical disturbances incident to this trying period may be said to be in inverse proportion to the health and vigor of the individual, the frail girl of indoor habits being likely to suffer considerably, while her strong and energetic cousin of the "Tom-boy" type will undergo the change from girlhood to womanhood with the very least inconvenience. Adolescence is the term often used to denote the period of youth between the beginning of puberty and the attainment of complete

physical maturity, in girls usually between the ages of twelve and twenty-one years, and in boys between the ages of fourteen and twenty-five, or thereabouts.

It is very important that the girl should be informed of the approach of puberty by her mother or some one else capable of giving her a clear understanding of the phenomenon of menstruation, so that she will not be frightened at its first appearance. She should be taught that it is a natural condition, and that it represents the possibility of motherhood. In this way she will avoid the mistake of regarding it in a distasteful light, but will on the contrary see in it the welcome evidence of her coming womanhood. She should be taught how to care for herself at this time. She should know, especially if she is not strong physically, of the increased size and weight of the womb at the monthly period, making it inadvisable to subject herself to physical strain at this time. But most of all she should know that suffering at this period is an abnormal condition, indicating something wrong, a state of affairs which may always be overcome and thereafter avoided by general physical culture methods for strengthening every part.

The Menopause, or "change of life," as it is so commonly called, marking the end of the child-bearing period in the life of a woman, usually comes at about the forty-sixth year, on the average, though varying in different cases as much as ten years earlier or later. Cases have been known in which it has occurred as early as the thirtieth year. In a general way it may be said that women who enjoy vigorous constitutions and a great deal of vitality usually retain the possibility of motherhood for a longer time than those less fortunate in the way of physical health and strength. It is sometimes said that those who commence to menstruate early continue to do so later than in the average case, while those who mature late arrive at the change earlier. This cannot be regarded as a rule, however, for precocity in this respect may be the result of artificial conditions, and is often likely to be disadvantageous. Prematurity is never desirable, and it often happens that the girl, who, leading a natural and active outdoor life, reaches puberty a little late, retains her youthful appearance, good looks and the possibility of maternity much longer than those who had the start of her by several years in experiencing the monthly function.

The menopause, sometimes also called the "climacteric," is usually the occasion of a great deal of anxiety, though there is no need of this if one takes proper care of her health. It is true that there are numerous and somewhat important changes taking place in the body, includ-

ing the cessation of the functions of the ovaries and womb, with the process of their atrophying or shrinking in size, and the readjustment of the nervous system to conform to the altered condition, but all of these processes will often take place in a strong and normally developed body with very few or even no unpleasant symptoms.

In many cases, however, there are various disturbances of the system, just as in the case of puberty. Irregularity in menstruation is one of the most common signs of the change. Sometimes the monthly flow will be entirely absent for several months at a time, and then suddenly reappear in an extreme form. Many women complain of hot flashes, headaches, migraine (pain in one side of head), digestive disturbances, cramps in the legs and in other parts. Nervous symptoms are most common, ranging all the way from mere irritability to apparent temporary mental derangements. It is well for others in the household to understand these facts, in order that they may be of as much help as possible in making the way easy. (See Part 5 of this volume.)

The Breasts, while not directly connected with the organs of generation, are intimately associated with them, and through their function of nourishing and sustaining the new-born babe they are of great importance in the general scheme of reproduction. They consist of the *mammary glands,* surrounded by a certain amount of fatty tissue. The breasts vary in size with different individuals and at various times of life in the same individual. Before puberty they are small and inconspicuous, but they gradually develop and enlarge as the generative organs develop. During pregnancy they increase in size, the glands secreting milk, which after the birth will be available for some time to come. After the change of life the glands shrink considerably, though the breast may sometimes retain its size or even gain in weight through deposits of fat. Otherwise, the entire breast will become somewhat atrophied. The left breast is often a little larger than the right.

The mammary gland consists of a number of lactiferous ducts, passing inward from their termination in the nipple and then subdividing and spreading around like the branches of a tree, ending in minute glands or lobuli, which secrete the milk. The lactiferous ducts are fairly straight tubes, perhaps ten or twelve in number, and dilating toward the nipple into the form of small reservoirs.

The nipple is a conical eminence, capable of undergoing a sort of erection from mechanical excitement. It has a wrinkled surface,

marked with small papillae, and is perforated by numerous orifices, the apertures of the lactiferous ducts. About the base of the nipple are numerous sebaceous glands which enlarge during lactation, secreting a fatty substance which serves to protect the integument of the nipple during the act of sucking. The surface of the nipple is dark colored and is surrounded by a colored ring known as the areola. The areola is of a delicate rosy hue in the virgin, but about the second month after impregnation it enlarges and takes on a darker tinge, which in some cases increases to a dark-brown color as pregnancy advances. These changes of color may be of importance in helping to determine the question of pregnancy.

Lactation is usually continued by a healthy mother for nearly a year. The nursing mother should not allow the child to hang on the breasts; instead, she should hold it well up to the nipple. Any such pulling down of the parts will tend to make them flaccid and shapeless. Loss of sleep, worry, anger and all other influences detrimental to the general well-being of the body, will likewise help to destroy the beauty of the breasts.

For those deficient in bust development, an improvement may be effected by local and constitutional improvement. (See *Improving the Bust* later in this Part.)

The Sex Organs and Health.—The importance of the sex organs in general health has been scientifically explained only within comparatively recent times. It is now known that as early as at ten years of age, these organs begin to secrete a fluid which is taken up by the blood and carried to every part of the organism. This wonderful internal secretion then begins its marvelous work of making over the entire body. Every bone, muscle, nerve and organ feels the effect of the magical fluid, and it is not long before we see the external manifestation of what has been going on within the organism. It is this internal secretion which causes the young girl to lose all her angularities and to take on the soft and gracious curves of womanhood. It is this which gives an added luster to her hair, a clearer color to her cheek, and a brighter light to her eye. Thus we see that the beauty which forms so large a part of woman's charm is directly due to the activity of these creative organs in their process of development, and we begin to realize that woman, as an individual, owes a debt of gratitude to these racial powers.

With the development of the body comes also an unfoldment of the mind. New emotions begin to make themselves felt, and impulses

toward self-sacrifice in the service of others may be observed. All these are expressions of sex. The beautiful maternal instinct which causes women to mother all with whom they come in contact gains an added impetus at this time. Think what it would mean to the girl and to others if she were to be deprived in any way of this life-giving impulse.

In order to develop to the highest degree the physical and mental powers it is necessary to live a normal life, and that includes the sex life. This is especially important in youth, for it is in this early period of life that we are laying the foundation, not only of our own future life, but of the lives of those who shall come after us. The development of the highest qualities of mind and body depends in very large degree upon the normal unfoldment of the sex powers.

It is especially important that young women should cast aside the reluctance which they may have felt for a study of this subject, and come into a full comprehension of what sex normally means in human life. They have gone so far, many of them, in their dislike for everything connected with sex, that they have even succeeded in suppressing many of the natural instincts and impulses of their own hearts. They have for this reason cut themselves off from much that would give them happiness and pleasure throughout their whole lives, and would enable them to be of infinitely greater service to the community in which they live.

Women must learn to rejoice in their womanhood and to make the most of it, in order that they may make their especial contribution to the life of the world. If they do not bring to the community that which belongs distinctively to them as woman, it will suffer for lack of that which no one else can give.

Improving the Bust.—If there is one feature in respect to which nearly all women are most interested in improving and beautifying themselves, it is in the matter of bust development. And furthermore, if there is any one particular in which the majority of women need improvement more than another, it is in this very respect.

The reason for this nearly universal desire for a perfect bust is not based purely upon the desire for beauty, although it is a very large factor. It is also partly due to an instinctive recognition that a good bust is the indication of superb womanhood. A normal bust development is regarded as implying the possession of all those qualities that make for true womanliness, not merely in the physical sense, but in a mental and spiritual way as well.

Femininity is not a purely physical quality, but is both mental and physical in nature. It is manifested through the brain and nervous make-up as well as in such external characteristics as absence of beard, refinement of features, greater delicacy of hands and feet and the characteristic pelvic structure. Femininity consists not only in the bodily conformation, but in the manner of thinking and manner of feeling.

All of these womanly qualities are suggested by a perfect and beautiful bust development. It conveys the impression of fitness for wifehood and motherhood. One does not look for masculine qualities in such a woman. The elements of womanliness are found to be highly developed. In other words, the possessor of a good bust is found to be perfectly sexed and in every way suited for the bearing of healthy and vigorous children.

Starting with this fundamental conception of the true underlying meaning of the bust, the reader will at once understand the general conditions necessary to a good development of this part of the body. It will be seen immediately that the woman who is lacking in vitality, who is poorly sexed, who has few of the natural instincts of womanhood and is generally far from fitted for maternity, would perhaps not be expected to show an ideal development of the bust. You can, in fact, take it for granted that the expectations of deficiency aroused in such cases will be realized.

The first requirement for improving the bust is to build constitutional vigor and those vital and nervous forces which are at the basis of a well-sexed condition. In other words, to build a superior quality of what may be termed womanhood, it is merely necessary to build vitality and constitutional strength. And having developed these qualities of all-around bodily and nervous vigor, you can depend upon an improvement in the condition and appearance of the bust corresponding to the altered state of health.

In Volumes I and II may be found general instructions for accomplishing these results. Plenty of sleep is perhaps the first requirement. Women commonly need a little more sleep than men. Often they secure less. The wife who sits up nights mending stockings after her lord and master has retired and found oblivion, and who then gets up first in the morning in order that his breakfast may be hot and ready when he finally rolls out, is not likely to make herself exceptionally attractive to him unless she finds some plan for getting a little sleep in the afternoon. In addition to this, a diet of live foods—that

is to say, a diet containing a considerable quantity of uncooked food, thus giving the necessary vitamins, with plenty of outdoor life and sunshine, and sufficient exercise to insure a vigorous circulation and a good general bodily development, will usually enable one to acquire that state of vitality that is the basis of either superb womanhood on the one hand, or virile manhood on the other.

There are two radically different types of requirements for bust improvement among women. On the one hand there is the need to reduce the bust and on the other to develop or build it up. In the first case the difficulty is often largely a matter of obesity, and a general fat-reducing program of food limitation and exercise will be necessary. In some instances the fatty tissue seems to have a tendency to localize itself in this region. In that case, special exercise and the general methods which will be suggested later will cover all requirements.

The more difficult case is that of the woman just past the flush of youth who is lacking in bust development, or who presents a too "flat-chested" appearance. In such a case there is a special need for the vitality-building program just mentioned, together with more or less locally stimulating natural treatment. It should be remembered that the breast is a glandular structure, and when these glands are either undeveloped or atrophied, the breast will naturally be undersized. Now, increased vitality and the development of all womanly qualities will mean a natural improvement in the quality and size of these glands, thus giving the bust the fulness it requires. Exercise alone will not build up the bust, because the bust is not primarily a muscular structure, but exercise is necessary to give tone and firmness to this region and to give the bust the capacity for supporting itself in the normal position, without drooping.

It is not merely the size of the breast with which women are concerned, but the question of its firmness and shapeliness, or lack of the same. The tendency to sag or droop is altogether too common, even among very young women. It is only natural that this result should follow when the bust is exceptionally large, inasmuch as the larger the bust the greater its weight, but this flabbiness is even experienced by many women with small breasts. It is due entirely to a condition of weakness and loss of muscular tone.

In some cases, the use of bust supporters and the wearing of tight brassiéres, or other artificial means of confining the breasts, are very largely responsible for the weakness and laxity of these tissues. In

other cases, the use of tight bindings following childbirth may have served to destroy permanently the shape of the breasts. If one has suffered the results of such influences it will be all the more difficult to restore a normal contour. It may be even impossible. Exercise is the one most effective method by which these parts can be strengthened and improved in tone. If only the breasts could be given appropriate firmness, that would in many cases be sufficient to beautify them. Exercise is the supreme means to this end.

But exercise is also essential to improve and round out the chest, which is equally important. The chest serves as a foundation, so to speak, for the breasts, and the improvement in the development and contour of the chest as a whole naturally gives the bust a better appearance. Even the normal bust on a flat-chested woman would appear undeveloped and would tend to droop, whereas with the chest well filled out and properly carried, the same breasts would have the appearance of beauty.

Cold-water bathing is another ideal means for invigorating and giving firmness to these tissues. For reducing the bust, cold water is especially important. But for the woman lacking in bust development it can also be highly recommended, since it improves the circulation in a marked degree and thus stimulates the activity and growth of the glands. In this case also, bathing of the parts with hot water or the application of hot, wet cloths for five minutes, followed by a quick sponging with cold water to contract and invigorate the tissues, should form a valuable part of the treatment.

Where reduction of the bust is desired, massage is another helpful measure. It may require a great deal of massage to bring about a small reduction, but it is one of the helpful agencies. In applying massage for this purpose, it is important to avoid any downward strokes, inasmuch as this would only accentuate the dragging and drooping tendency, which always tends to be marked when the breasts are large.

For lack of bust development, any influence which improves the local circulation would be helpful in stimulating the glands. On this account, some form of vacuum or suction treatment which does not unduly stretch the tissues would be helpful. The old-fashioned suction treatment applied by the placing of a hot bowl over the parts involved can be suggested. As the bowl cools, the air contracts, forming a partial vacuum and thus drawing the blood to this region. A simpler method is found in the use of the ordinary breast pump, sold at drug

stores for the relief of nursing mothers, but which may be used for this purpose if applied not only over the nipple but successively over other parts of the breast as well.

A great many women of normal development think themselves lacking in this respect because of a false impression as to what is the proper size of the bust. The normal and healthy breast should not be overlarge. It is only during pregnancy and lactation that the breasts become very prominent. Women with exceptionally large breasts very often fail to nurse their children, whereas the woman with a comparatively small, firm breast more frequently rises to the occasion. The ideal development is that popularized in the masterpieces of sculptor. It is firmness and shapeliness that is desired, more than excessive size. And if the chest is properly built up, such a bust gives one the contour and outlines of true womanly beauty.

Fitness for Marriage.—To be mother of a child is the hope and joy of every normal woman. To be denied this privilege is one of the keenest disappointments of her life, in many cases being the cause of wrecked homes and continual unhappiness.

Sterility is practically always due to some disease of the genital tract of either the husband or wife. In this chapter we will not consider the former although he is responsible in nearly half of the cases. If no cause can be found in the woman, it is possible that a close examination of the husband will determine the reason for the absence of children.

Sterility is the condition in which a woman is incapable of reproduction. It is considered absolute sterility when no conception is possible, and relative sterility when conception occurs but the foetus dies.

There are many conditions which are said to be responsible for absence of the ability to bear living children. The majority of all cases are due to inflammatory disease of the uterus, tubes, or ovaries, often the result of infection. The inflammation causes a thickening of the walls of the Fallopian tubes, which, together with the pus and catarrhal exudate, so occludes the lumen that either the ovum cannot reach the uterus, or the spermatozoon is prevented from fertilizing it. Often, too, the ovum is prevented from leaving the ovary because of thickening of the covering of the latter. The lining of the uterus may also be so injured by the inflammatory process that it is no longer a suitable field for the attachment of the ovum, even after fertilization.

Lacerations and ulcerations of the cervix may be responsible for the

failure of fertilization, these conditions preventing the entrance of the spermatozoa into the uterus. Syphilis, tuberculosis, polypi and tumors may also be mentioned as causes of this condition.

Congenital malformations are occasionally responsible, such as imperforate hymen, absence of ovaries, tubes, uterus, and even of the vagina. Early marriages are more often childless than later ones, the most fertile being those occurring at from twenty to twenty-four years of age. Displacements, distortions and certain curvatures of the uterus also cause sterility.

It is also certain that a lowered condition of the health of the woman is likely to destroy the childbearing function, although it sometimes happens that the bearing of children acts as a stimulus to the functions of the body and good health follows.

The habitual use of alcohol is considered by some to be detrimental to fecundity. Just how this acts it is impossible to say beyond that it lowers the nervous tone and general health of the body. Overwork, worry, and emotional disturbances may at times so depress the nervous and physical powers of the woman that healthy ova are not secreted.

Venereal disease is too often the cause of sterility. This may be gonorrhea in either the husband or wife, causing destruction of testicles or ovaries, or, as occasionally happens, a chronic inflammatory condition of the spermatic ducts of the man, or of the Fallopian tubes of the woman, producing occlusion which prevents the passage of the male and female elements of conception.

That syphilis is a potent cause of nonpregnancy is maintained by many urologists and gynecologists. Whether it is truly syphilis, or the treatment usually taken for this disease, has never been determined. It is certain that the mercury and arsenic used in the treatment of syphilis, with the idea of killing the treponema pallida in the blood, cannot fail to have a degenerative effect upon both the spermatozoa and ova. There are many cases on record, however, where healthy children have been born after either one or both parents have been infected and received treatment. Personal health is probably the deciding factor after all.

Sterility, of course, necessarily follows operations for the removal of the tubes and ovaries. If one tube and part of an ovary are left, pregnancy is possible.

A woman thinking herself sterile should undergo an examination to determine the presence or absence of inflammation, growths, or malformations. If there is inflammation of uterus, tubes or ovaries,

treatment for these conditions must be instituted. If there is a displacement, it must be corrected. In case of imperforate hymen, a slight surgical operation is indicated. If there are malformations, or one of the necessary generative organs is absent, there is, of course, no remedy.

Very often there is such an excessive leucorrhea of an acid nature, that the spermatozoa are either killed or prevented from reaching the uterus or tube. In such cases a vaginal douche, consisting of a teaspoonful of baking-soda and a teaspoonful of common salt to a quart of water, may remedy the condition. The normal reaction of the vaginal secretions is acid, but in case of ill-health they may become unduly so.

If none of the above conditions can be demonstrated, a general health-building regimen should be taken up, along the lines laid down in Vol. II, Part 9. In very many cases it will be found that improved health will be followed by conception.

Women should understand that not only may a lack of vitality resulting from overwork, want of food, or actual disease, be the cause of sterility, but that there are also mental and emotional conditions which may cause barrenness. Prolonged or intense mental depression or excitement, anxiety, fear, grief, suspicion, jealousy, anger, revenge, are not only strikingly preventive of conception but also of normal ovulation. Such states, too, may render the male reproductive germs incapable of impregnating as well as the female germs incapable of receiving fertilization. They may also prevent the normal development of an embryo after fertilization has once been effected.

One other cause must also be considered. This has been termed a lack of adaptation. The husband and wife may be so fundamentally unadapted to a real union of life that their physical union does not result in conception.

As has been stated, the husband is too often to blame, and it is needless to say that he should investigate the matter and take as great care of his health as the wife. Indeed if there is no obvious cause in the wife, the condition of the husband should be ascertained before the wife is subjected to examination.

The time of the connection is often responsible for the failure of pregnancy, although this is not absolute, inasmuch as pregnancy is possible and has occurred at any time. If intercourse takes place within a week after menstruation, however, pregnancy is more apt to follow.

Conception and childbearing are normal functions of woman, and just as other bodily functions are dependent upon good health, so the occurrence and satisfactory termination of the reproductive crisis is dependent upon this condition.

Young Girls and Menstrual Care.—As has been said, the functioning of the creative organs is, in reality, but a continuance of the dividing process which first took place in the germ plasm; only now, instead of the cells remaining together, once every twenty-eight days approximately, one little cell is budded off from the germ plasm and starts on its own individual journey through the bodily organs.

It must be understood, in the first place, that the uterus is lined with a membrane which corresponds to the lining membrane of the lips or the eyelids. A moment's scrutiny will show that this thin, transparent membrane is filled full of a fine network of tiny arteries through which the blood flows, giving to it a rich, red color. So also is the lining membrane of the uterus filled full of tiny arteries. At the menstrual period these arteries are filled so full of fluid that their walls are stretched thin, as is a piece of rubber when stretched taut. Through these thin walls the blood slowly exudes, gathering on the inner surface of the uterus until it has gained enough volume to move slowly on its way out of the body. Now, it will readily be understood that when the lining membrane is thus engorged with blood, the uterus is very much heavier than at any other time during the month. At the same time, the muscles are more or less relaxed in tone, so that the whole group of pelvic organs tends to sag downward. To relieve this sagging, girls are taught to spend as much time as possible in a reclining posture for the first day or two, when the organ is most heavily weighted with extra fluid. This care will often prevent a permanent sagging of the organs which might ultimately result in increasing the suffering at this period.

It also becomes apparent why it is so necessary to avoid getting the feet wet at this time, or running any risk of taking cold. Sitting upon the damp ground, or upon a cold stone, is particularly dangerous, because it may cause a checking of the flow, resulting in a congestion which may become more or less serious.

There have been cases in which young girls have injured themselves because, through ignorance, they attempted by cold bathing to stop what seemed to them a manifestation of some serious hemorrhage. Fortunately, mothers of today are generally aware of the

importance of giving their daughters proper instruction before this function has begun, so that such mistakes are much less frequent than they may have been in years gone by.

Girls often resent the necessity for taking special care of themselves at this time, and sometimes even seem to think it an indication of a praiseworthy strength of mind and will to refuse to exercise a little common-sense caution. There are, of course, many young women, and it may be that the number is increasing, who do not find it necessary to pay any especial attention to themselves at this time of the month. They are able to go on about their ordinary occupations without suffering any pain, or any other marked inconvenience. There are others, however, who, if they persist in their customary activities for the first day or two, either suffer a great deal of pain, or else find themselves flowing for an undue length of time. It is generally considered that normally the flow should be ended by about the fourth or fifth day. If the period is extended over a week it should be looked upon as abnormal and an effort made to discover and remove the cause. It will be found, in a good many of these cases, that remaining in bed for the first day or two will bring the function to a close within the proper period of time.

It is especially important that young girls should exercise this special care over themselves during the first year or two of menstruation. When the function is once thoroughly established, it may not be necessary to be so careful.

The question of bathing at the menstrual period is discussed under *Menstruation,* on an earlier page of the present part.

Sex-Silence and Its Results.—For generations women have been made to feel that sex was something of which they should know nothing. While they were forced to admit that their womanhood was an expression of sex, they put it out of their thoughts as much as possible. They seemed to prefer to think of themselves as sexless beings. They felt apologetic for being women, and in this unnatural attitude of suppression and denial of their sex, they lived and died without ever realizing the glorious possibilities of their distinctive natures.

Sex is not something which is localized in the human body, pertaining only to a certain set of organs. Sex is a universal principle which expresses itself in all but the very lowest forms of life. It permeates every atom of the physical structure, so that each tiny cell expresses either masculinity or femininity.

It is as though Nature had divided the living material in the uni-

verse into two portions, and bidden one-half to specialize in certain characteristics, the other half to specialize in other characteristics, and this work of specialization has gone on progressively with the evolutiontion of high forms of life and will continue to do so as long as the world lasts.

To this division of the life-force into two expressions we owe the most important relationships of life. The relation of husband and wife, parents and children, brothers and sisters and relatives of all degree, of friend with friend, all find their root in this universal principle of sex. Not only beauty of soul, but much of the beauty of the universe springs from this same great principle. The blossoms of flower and shrub and tree are the expressions of sex in plant life. The coloring of the wings of the bird and the song that he sings are expressions of the same great force. The effort of the lower forms of life to provide nourishment for their offspring furnishes us with the greater part of our food—our grains, tubers and bulbs, our milk and eggs. Sex, we must understand, is but the means chosen whereby life may be continued upon the earth. Through the mating of male and female all the great varieties of life have been made possible.

The study of the life-giving function of the body, therefore, if undertaken from a wholesome incentive, should always be an uplifting one. That it calls for the contemplation of physical details should not distress us. To be truly successful in our lives we need to come into an understanding of the laws governing this body, in order that we may make it our efficient instrument of expression.

Every part of the body should be pure and clean, and is equally worthy of respect. That we have not always realized this has been due in large part to the misuse of the bodily functions. Indecency is a question of behavior, and does not pertain to the body itself. Impurity belongs, not to sex, but to the mind of the individual. It has been well said that "to the pure all things are pure." Even in contemplating wrong-doing, we can realize that it is but the misuse of that which in its normal use is right and beautiful. It is only of the abuse of a function of which anyone need feel ashamed.

The feeling of shame once so commonly associated with the subject of sex has been due almost entirely to ignorance. With no understanding of sex in the normal, and seeing only the terrible consequences of this power when directed solely to selfish gratification, it is no wonder that the average individual has come to look upon the whole subject with a feeling of disgust. It is not surprising that parents

have been horrified at the suggestion that they should talk with their children upon the subject of sex, because to them that meant discussing certain sins of the human race with their terrible consequences. The distinction between the use and misuse of these powers, however, is now better understood. Today it is possible to suggest that one should study the subject of sex without immediately arousing an attitude of mental resistance and condemnation upon the part of one's hearers.

The masculine impulse is positive, active, destructive. The feminine impulse is passive, negative and constructive. These two, therefore, supplement each other, and both are essential to a fully developed, well balanced racial life. Here is found the strongest possible reason for joint responsibilities between man and woman in the government of a community or a nation. Neither one of these two beings can fill the place of the other, and both are equally essential to a well-rounded, perfectly balanced life.

Sensuality and Mating.—The young woman is supposed to be chosen, not to choose, but anyone who is acquainted with the real facts in the case knows that, in reality, it is the young woman who exercises the power of choice of male companions. She it is who attracts and draws to her the individual who is most pleasing to her tastes.

Let her choose, then, first of all a man who is physically strong, mentally alert, and clean and upright. Without these essentials of physical health, mental capacity and moral integrity, a man is not fitted to make a successful husband and father.

If a young woman follows her own intuitions and cultivates her own keen critical faculties, she will be able to judge fairly well for herself in all of these matters. She can tell by a young man's clear eye, upright carriage and springy step that he is in a condition of abounding health and vitality. She must have, therefore, some standard of choice. She must realize what it is she is selecting this man for.

The real vital function of the man of her choice is to be the father of her children. If parents were willing and able to answer the early questions of their children as to their own origin, and to continue talking sensibly and seriously with them upon the subjects related thereto whenever their inquiries indicated a desire for further enlightenment, young men and young women would grow up with a thorough understanding of the importance of the parental function. It sometimes even shocks a young girl to suggest to her that she should consider the welfare of her possible children when she is thinking of accepting some young man's proposal. It should not be a shocking

suggestion to her, however, and would not, if she had been brought up to think rightly upon this vitally important subject.

A woman's intuition will generally guide her, if she will but listen and follow its indications. Unfortunately, too many women are in the habit of silencing this inward monitor, and so lessen the protection which it is intended to afford them. These men have learned through their association with women of another type just how to stir the sex nature of a woman, and through their powers of fascination they stimulate that side of a woman's nature which causes her to refuse to listen to hints of danger and insist upon following her own desires.

Many girls have not learned to distinguish between their own higher and lower desires, and do not recognize this persistent and disturbing warning. The girl who is honest with herself will be able, through their different effect upon her own emotions, to distinguish between the glance of frank admiration from a pure-minded man, and the look of sensuous enjoyment from one of the dangerous type referred to. From a man's conversation, also, much may be learned of his thoughts. If these appear to be running always in the direction of sensuous pleasure, if not of sensuality, the young girl would do well to govern her actions with discretion, and to turn resolutely away from any intimacy with a man of such caliber.

Physical Familiarities and Passion.—The essence of passion would seem to be intensity of feeling. For this reason, passion cannot be expected to be enduring. It is not possible to keep the human soul at white heat all of the time. Its elements may be present at all times, but only on rare occasions do they fuse and give forth the intensity of ardor which they are capable of producing.

With the beginning of the adolescent period, there comes an increasing intensity in the emotions which may cause the developing boy and girl to think that they are in love with each other. It is not advisable to laugh at them for their early sentimentality, which is sometimes called "puppy love." Rather would it be advisable for older friends and guardians to accept the expression of extreme admiration in a very matter-of-fact way, admitting that the individual in question is most attractive, and that it is not strange that the two have formed a very agreeable friendship. By consistently holding up the ideal of friendship before their eyes, we may be enabled to avoid some of the pitfalls of the adolescent period.

It is quite natural for young people who feel these new emotions stirring within them to give expression to them. Especially will this

be the case if they have received no instruction which would enable them to understand the real meaning of that form of physical familiarity known as spooning, which takes place among so many adolescent boys and girls.

This question of spooning really becomes quite a problem in the lives of many young girls. They are going out into social life for the first time by themselves. They know, it may be, very little of social customs; they find that their older companions are indulging in so-called innocent forms of physical familiarity, and they accept the standards of conduct which they see round about them.

If they are a little hesitant, they are informed by the boys that all girls allow these things, and they are given to understand that they cannot hope to be very popular if they insist upon refusing these privileges to their escorts and male companions. They are told that there is no harm in these things, because no harm is intended. It would not be strange if their own feelings inclined them more or less in the direction they are urged to take, and so we find today that a great many young people have allowed themselves to drift into relationships which are anything but healthful.

Sometimes young people enter into what they acknowledge to each other as a temporary engagement, simply in order that they may feel free to indulge in as much of this kind of love-making as they care for. They think, by thus satisfying Old Mother Grundy, as they would doubtless characterize the conventional requirements, they have escaped all rightful censure. They have not escaped, however, the real consequences of their own acts. These results are to be found in themselves.

In the first place, they are taking a very light and trivial attitude toward that most serious phase of life, love and marriage. They are making common that which should be sacred. They are defrauding those whom later on they will choose to marry of much that is choice, and of rare and delicate beauty, in the relationship of two who have entered upon a lifelong companionship.

There are, of course, other possible dangers. Two young people who have entered into this sort of relationship are not striving to find the mental and spiritual qualities in each other which will bring lasting delight. They are looking only for the physical thrill which they derive from their association together. They are, therefore, meeting each other upon the lower, rather than upon the higher plane of their being. There is danger that the result may be disastrous for them

both. The clasped hands, the arm about the waist, the good-night kiss, seem to be little things in themselves, but they are liable at any moment to stir into activity the strongest impulses that dominate the human being.

Oversexed and Undersexed Mates.—With the development of the idea of personal freedom has come the feeling, on the part of many women, that they should have the right of ownership of their own bodies—in other words, that they should have the privilege of choosing whether or not they will acquiesce in their husbands' desire for entering into the physical relationship of marriage.

Since, however, it has been for so long a time an accepted idea that the husband's right over the wife's body was inherent, it is advisable for any young woman who takes the other point of view to make her attitude thoroughly understood by her future husband before she definitely takes upon herself the obligations of the marriage state. Fortunately, these subjects are more open for discussion today than ever before, and there is no reason why two young people, approaching matrimony, should not discuss this most important question carefully and frankly together.

If the young man understands the young woman's attitude, and is ready to acquiesce in it, their life together will be established upon a firm foundation of mutual understanding, and in the after years there will be no opportunity for recriminations, or for the accusation that the man was led into a union whose obligations the woman did not intend to fulfil.

On the other hand, however, many women have need to ask themselves whether they have the right mental attitude toward this question of the marriage relation.

For generations women have been so trained to look upon this physical relationship as something to be condemned as belonging to the lower forms of life, and, therefore, beneath human beings, that they have arrived, many of them, at an abnormal state of sex-suppression. They do not dare to follow their own natural impulses, and they do not realize how unnatural their condition really is. They live in a constant state of mental conflict which is most detrimental physically, and most disturbing every other way. If they could realize that the racial impulse is the highest physical impulse which comes to human beings, that it serves a great and noble purpose, and that it is only its abuse which we need to guard ourselves against, they would gradually free themselves from this unnatural bondage to old-

time Puritanism, and eventually come out into the freer life of the normal individual.

There may be those who have advanced to the point where they do not need this physical expression of their sex natures. The average human being, however, needs a normal physical expression of this side of his or her nature, and in a successful marriage husband and wife cooperate to find out what is the basis of their mutual satisfaction and highest happiness.

A word of suggestion might be spoken here to the average young woman to avoid the man who is overdeveloped sexually, and who, therefore, will be likely to make too great demands upon his wife. The man of self-control, who shows consideration for those about him, can generally be trusted to exercise these same qualities in the intimate relationship of marriage.

In this matter of consideration, a woman can get a pretty good line on a man by observing his attitude toward his mother and his sisters, and his treatment of them under everyday conditions. If she can get an invitation to visit in his home, she stands a fairly good chance of getting an idea as to what she can expect from him after they are established in their own home.

Overcoming Errors of Youth.—It is unwarranted to believe that because of unhappy sex experience a girl has no right to a husband and a home of her own. She may even make the mistake of her youth a part of her own spiritual unfoldment and a means of becoming a more sympathetic, helpful member of the community. With the remembrance of her own weakness in the background of her consciousness, she is able to enter into the temptations of others, to strengthen them for resistance and for the ultimate mastery of untoward circumstances. Thus she may become a real source of moral strength in the community.

With this belief in the power of human nature to rise above its own weaknesses and to turn them into sources of strength, we do not consider it amiss to speak of the possibility of marriage for one who has learned the bitter lesson of the unsatisfactoriness of wrongdoing.

Many times the very qualities which render such a girl attractive to the man who brings about her ruin, are the qualities which will make her most successful as a wife. Loving and demonstrative, she falls an easy victim to her seducer. Had she fallen into the hands of the right kind of man, she should have made him a docile and

loving wife. Having learned through experience the necessity of guarding herself from the approaches of the consciencceless man, she is equipped to maintain her own moral integrity, while she is just as fitted to make a success of herself in the home as she was before this hard lesson came to her.

The girl who has awakened to a sense of her duty, has a right to look forward to the ordinary joys of womanhood, but she is, of course, face to face with the question as to whether or not it is fair and just for her to accept a proposal of marriage from one who is unaware of her previous sad experience. The question that springs spontaneously to the lips of the young girl who is trying to make good, and who finds herself the recipient of a man's honest love is, "Must I tell him of my past experience?"

The question is, indeed, a difficult one, and must be considered carefully from both sides. Then each individual must decide her own course of action for herself.

In the first place, there is, of course, the danger that if the man has had no suspicion of the girl's past history it may come to him with such a shock that he will turn from her and desire to have nothing more to do with her. She runs that risk, of course, in confessing to him her past. Should her story meet with this sort of reception, however, she may console herself with the thought that by so doing he has proven himself not worthy of the deepest love which she had to bestow. It has not been considered too much to ask of women in the past that they should spread the cloak of charity over the misdoings of their lovers in the wild years of their youth. It would seem as though it might be possible for men to exercise a corresponding generosity, especially where, as in the majority of instances, the girl has been very largely but little more than a weak and innocent victim. It speaks well for the development of the human race that there is an increasing number of men today who are willing to overlook the past, feeling confident that the bitter lesson has been learned, and resting secure in the knowledge that their love and strength will bring to the yearning feminine nature the satisfaction and the support which it needs to render life both happy and secure. Instead of regarding her story as the possible cause of a great disappointment to her, she should look upon it as a great test of the sincerity of the man's devotion, and so she will not be afraid to apply it.

Moreover, if her lover leaves her at this time, she must realize that

he has but left the way open for a more worthy man to find his way into her life.

To confess all to a lover in the ardent period of courtship is to appeal to the very best in a man's nature, by thus throwing oneself upon his mercy, and he will, in all probability, rise to the occasion in a most generous and gratifying manner. Having agreed together to put all of the past behind them, there will be no overshadowing fear to threaten its disrupting effect upon their united love.

In concealment there is the danger, also, that the knowledge that she is concealing something from her husband will tend to act as a continual barrier between the two, and for this reason it would seem wisest for the girl who has made a misstep to confess it at the very beginning, and thus establish their united life upon the only sure foundation, that of mutual confidence and mutual faith.

Processes of Generation.—Sex is looked upon very largely as though it were not only centered in, but entirely encompassed by, the creative organs. In reality, sex permeates every atom of the body. Every molecule of the woman's organism expresses the characteristic of femininity which is, in its essence, passive, negative, constructive. The masculine element, on the other hand, is positive, active and destructive.

In the higher forms of life, instead of one single cell we find many cells grouped together to make up the organism, and the work which is necessary to sustain the life of this creature is divided up between different groups of cells, which are called organs. Some of these organs are necessary for carrying on the life of the individual and some are essential only to the continuance of the life of the species. In humankind, two different organisms are essential to the reproductive process: one producing the feminine element, the other, the masculine element. These two must unite in order that a new life may come into existence.

This differentiation between two individuals is an expression of the law of sex, and very evidently has for its purpose the production of greater possibilities of variation and ultimate improvement in the species.

It gives us a truer conception of the rightful place of sex in life when we realize that the manifold varieties of different species owe their origin to this great principle of sex. For example, there was in the first place but one kind of a rose, the wild sweetbrier, and from this, we are told, by the process of selection made possible through the law

of sex, have been developed the many hundreds of varieties with which we are familiar today. So we may enumerate the various forms not only of plant life, but also of life in the animal kingdom.

As soon as the sperm cell, or the masculine element, has united with the ovum, or the feminine element, there begins in the ovum thus fertilized by a spermatozoon a marvelous division and subdivision which, in a remarkably short space of time, results in a form which is composed of a great number of tiny cells, held together in a spherical mass and having the appearance of a mulberry.

If you were to be told that a human body was to develop from this mass of cells, and were asked to apportion the amount which you thought would be needed, in the first place, for the creative organs alone, and, in the second place, for the entire remaining portion of the body, you would, without doubt, divide the cellular mass into a larger and smaller portion to correspond with the size of the body and the creative organs. It may, therefore, be of interest to you to know that, when this part of the developing process is reached, one single cell is set aside for the purpose of being developed into the whole complicated organism of the body, which grows about and surrounds the remaining mass, destined to form the creative organs. It becomes evident that the entire human body exists for the purpose of protecting this living germ plasm. The Part following explains the service of woman in the early development of this new organism, and also the general processes of motherhood.

TABLE OF PREGNANCY

Indicating probable date of termination.

Commencement of Last Menstruation		Date of Birth		Commencement of Last Menstruation		Date of Birth	
January	1	October	8	July	6	April	12
	7		14		12		18
	13		20		18		24
	19		26		24		30
	25	November	1		30	May	6
	31		7	August	5		12
February	6		13		11		18
	12		19		17		24
	18		25		23		30
	24	December	3		29	June	5
March	2		7	September	4		11
	8		13		10		17
	14		19		16		23
	20		25		22		29
	26		31		28	July	5
April	1	January	6	October	4		11
	7		12		10		17
	13		18		16		23
	19		24		22		29
	25		30		28	August	4
May	1	February	5	November	3		10
	7		11		9		16
	13		17		15		22
	19		23		21		28
	25	March	1		27	September	3
	31		7	December	3		9
June	6		13		9		15
	12		19		15		21
	18		25		21		27
	24		31		27	October	3
	30	April	6				

PART 15

MOTHERHOOD SIMPLIFIED

MANY women fear the crisis of childbirth. Many others avoid motherhood because they "wish to retain their youth and their figures."

The average woman seems to be saturated with the unwholesome notion that motherhood means the loss of her figure, her health and her youth, blaming upon this natural function the inevitable results of unhygienic and improper modes of living. She believes that maternity will mean the sacrifice of herself for her child.

No woman is really her complete self until she has become a mother; she cannot until then know the fulness of life, all that life means for her, nor understand the forces of her own nature. And far from losing her health and her youth through motherhood, the hard physical facts of the case are that she thereby preserves her youth and her health. In innumerable cases, even without any knowledge or practice of physical culture measures, the health of a woman has improved after becoming a mother so that her friends would hardly know her. And as for youth, we need only recall that more women than men reach an extreme old age, and that practically all of these very old women have been mothers, not usually once or twice, but generally mothers of very large families. So if you seek health and prolonged youth, the very best policy is to live a normal life in this respect and fulfil the maternal function.

The theory that a woman loses her figure through it is absurd, as is evidenced by the experiences of many women who have had a generous number of children and preserved their beauty unaltered. And everywhere there is evidence that sterility is no guarantee of the retention of physical comeliness. How many times have we observed the lack of figure and of beauty in "bachelor maidens," and in married women who have avoided children? The women themselves know only too well the sagging, drooping state of their breasts, even though these have never served their intended purpose, and the flaccid, protruding aspect of their abdomens. Motherhood is not to blame in such

Some helpful forms of exercise for early pregnancy may begin in standing position here shown. The objective is to bend and twist the pelvic region so as to develop flexibility and muscular tone. Stretching forms of movements are undesirable, especially after pregnancy is well established.

cases surely, and when those who actually have been mothers display the same deficiencies, it is not because of motherhood, but because of the other degenerate conditions which have robbed them of their physical soundness and vigor.

It is the purpose of the pages that follow to present a summary, practical although brief, of the most important of the processes of pregnancy and of childbirth

Abortion.—See *Miscarriage*.

"After-Pains."—Following expulsion of the placenta, so-called after-pains, due to the contraction of the uterus, are sometimes experienced. The application of hot dry cloths or the hot-water bag will usually assuage these pains.

Age.—*Its Effect on Childbirth.* It is generally accepted as true that an age from twenty to thirty-five years, constitutes the best period of a woman's life for child-bearing. Those whose first child is born to them during the early twenties may apprehend somewhat less difficulty than those in whom the event occurs in later years.

While in many cases child-bearing between the age of thirty and the period of the menopause is attended with more difficulty and pain in the instance of the first child than in younger women, it is usually found that the danger to the mother of more mature years is not especially greater than that to younger women.

In women bearing their first child at a mature age it is particularly essential that they take advantage of every possible means of preparing for motherhood in the manner set forth in this volume.

Bathing During Pregnancy.—Cold baths (especially cold sitz-baths) are of great value in the first few months in building vigor and functional tone, but in the later months they should be avoided. Some women might take them safely, but in other cases there is a risk. Cold baths, by their reflex nervous influence, tend to cause contractions of the womb, and might possibly cause premature labor. Cold sitz- and foot-baths especially have this reflex effect.

Hot baths for cleansing purposes should be taken at least twice each week. During the last few weeks they should be as brief as practicable.

Bearing Down Pains.—If there are bearing down pains and a sense of weight in the pelvis, and these symptoms are not relieved by the cure of constipation, then exercises on an inclined plane, with the hips a little higher than the level of the shoulders, such as are often recommended for the ordinary weakness of women, will be advantageous. Movements of the legs chiefly should be used in this case. The mere position of lying upon an inclined surface, with the feet higher than the head, without any exercise is a valu-

From the standing position first illustrated, the hands may be brought down together to touch the floor, at first on one side, and then on the other, the knees being kept straight, and the body bent at back with each movement. The object of the exercise is to strengthen the side and abdominal muscles, and it may be repeated safely until these muscles are tired.

able resting position to be assumed frequently for short periods to relieve the pressure on the bladder as well as the bearing down sensations.

Conception.—Whenever the male spermatozoön joins the female ovum (egg) within the woman's womb, conception will take place. Normally the female organism liberates from its ovaries but one ovum each month (usually during menstruation); it will, therefore, be plain, that although the male discharges millions of spermatozoa at each intercourse, conception need not necessarily follow. However, the spermatozoön retains its life and ability to impregnate the ovum for a long time after its discharge (ten to fifteen days), while the ovum remains in the womb and is also capable of impregnation for about five days after menstruation. Thus it will be seen that, on entering the womb, the spermatozoön may either meet an ovum which has been discharged at a previous menstruation, or else it may remain in the womb uninjured for a number of days and finally come in contact with a newly discharged

An exercise performed by bending at waist and bringing first one hand then the other to touch the foot of opposite leg. The position of feet is reversed back and forth after each movement, and the exercise repeated as often as possible without harmful exhaustion.

ovum (at next menstruation). In either case conception (also called impregnation) is likely to take place.

As soon as this has happened, the impregnated ovum becomes attached to the inner lining (mucous membrane) of the womb, and begins its new life as an embryo. The period comprising the time from the impregnation of the ovum until the beginning of labor (childbirth) is called pregnancy.

Diet During Pregnancy.—A great many women realize more or less, as if by instinct, that the question of food has much to do with her welfare and especially with that of the child, but in the majority of cases her ideas upon the subject are incomplete, unintelligent or altogether mistaken. In many cases, women feel that they must eat as much as possible, because of "feeding two." Never was there a greater mistake, for the always detrimental influence of overeating is doubly injurious under these circumstances. Above all things, there should be no forcing of the appetite, and no eating without appetite. The normal appetite and instinct may be trusted. If one lives outdoors as much as she should, she will not fail to have an appetite.

Fruits and fresh, green salads are useful during the early months in combating tendencies to nausea, if there are any. As a matter of fact, it would not do any harm to live almost entirely upon these for several days at a time if the appetite should fail and one cannot relish

This floor exercise for strengthening the waist and side muscles is performed by bringing the hands alternately forward to touch the toes with finger-tips. It may be continued as long as the muscles involved can perform it without undue fatigue.

heavier and more substantial foods. Oranges, grapes, peaches, berries, grapefruit, apples and the like are particularly gratifying.

In all cases, foods should be simple and wholesome. Fried dishes and complicated mixtures should be left alone. All palatable raw foods are particularly recommended. For instance, it is better to eat the raw, fresh cherries or apples, than to eat apple pie or cherry pie. In the way of desserts, stewed fruits, simple rice puddings, tapioca and other similarly wholesome foods are best. Whole wheat bread should be used exclusively in place of white flour products, if only to combat tendencies toward constipation.

Exercises During Pregnancy.—Exercise during pregnancy is important for the same reason that it is indispensable at any other time if one wishes anything like true health.

It is well, early in the course of pregnancy, to devote considerable attention to exercises for strengthening the abdominal region. Some of these exercises may be continued to the very end of the term, but the more vigorous or violent among them may gradually be discontinued with the increasing size of the body. The function of birth really depends upon the contractile power of the muscular tissue of the womb, and surely one cannot expect this organ to be vigorous if the general external muscular system of the body is flaccid and relaxed. One may, indeed, judge of the condition of internal muscular structures by the development of those externally placed. It is not simply strength that is desired, but elasticity as well—elasticity above all things. And this elasticity is not to be found, cannot be expected in a body that is weak and inactive—stiffened by inactivity.

Violent exercise during the later months should be discouraged, though moderate exercises should certainly be kept up to the very last. Walking is undoubtedly the greatest of all beneficial exercises for the prospective mother, and, if possible, it will be well for her to cover from six to ten miles daily.

Early Symptoms and Signs of Pregnancy.—The sooner one can determine the existence of pregnancy, the sooner all measures leading to an easy childbirth can be instituted. It is, therefore, important to be able to diagnose pregnancy as early as possible. The diagnosis is based on the early appearance of certain symptoms and signs which, although not characteristic when taken singly, become very valuable when they appear simultaneously.

First and foremost among the early changes of pregnancy one notices the disappearance of menstruation. For itself cessation of

menses does not necessarily mean pregnancy. There are a number of other conditions, such as anemia, chlorosis, certain mental and nervous disturbances, climacteric, beginning consumption, in which the menses may be delayed or cease. On the other hand it must be remembered that pregnancy may exist, even though menstruation goes on as usual.

All the other changes taking place during the first few weeks of pregnancy are so slight in their onset and gradual in their development, that for a while they remain entirely unnoticed. Soon, however, one or more symptoms appear that make it probable that pregnancy exists, and as time moves on the probability changes to a comparative certainty.

There is often a sense of dizziness, a disposition to faint, or even actual fainting spells may occur. Perversion of taste may appear, with strange fancies for eating unusual, sometimes disgusting articles.

With or without the above symptoms there occurs at a very early stage of pregnancy, usually in the morning, a sensation of nausea, which very often culminates in vomiting (the vomiting of pregnancy). The latter in some, fortunately rare, cases becomes so excessive as to endanger the life of the woman.

Constipation, of which women in general so commonly complain, frequently becomes marked during pregnancy.

From the position illustrated, the hands are pushed forward as far as they can reach, keeping them upon the floor meanwhile. The tendency of this movement is to exert the muscles of the lower abdomen, and it should be repeated as often as the strength of these muscles permit without distress.

Owing to an increased blood supply to the breasts there is a tingling sensation, with a feeling of fulness in the latter. The nipples grow large, the dark field around the nipples grows darker and wider.

Similar discolorations may appear in other parts of the body—in particular a dark line running down the middle of the abdomen from the navel to the pubic bone (symphysis). Dark blotches and discolorations of the skin often appear on the face and elsewhere.

Whenever several of the above symptoms occur simultaneously, one can diagnose with great probability the existence of pregnancy, provided, of course, that sexual intercourse took place some time previous to the appearance of these symptoms.

However, the diagnosis can not be absolutely positive until such later period, when one can ascertain the existence and development of an embryo.

Fasting.—During pregnancy, fasting for a prolonged period is not advised, but if there is a loss of appetite or if a digestive disturbance requires a short fast, it is certainly better to fast than to eat and prolong the disorder. Of course, care should be observed when this form of treatment is adopted.

Food.—See *Diet During Pregnancy.*

Growth of the Embryo.—At the time of its impregnation the ovum is a single cells, measuring about $\frac{1}{120}$ of an inch in diameter. As mentioned before, it becomes adherent to the mucous membrane of the womb soon after its impregnation and begins its life as an embryo. The development of the embryo from the cell is too intricate to be given here in detail. Suffice it to say that by a process of successive division and subdivision of the original cell and by a differentiation of the resulting cells into various tissues, the ovum not only grows rapidly in size but also assumes distinct shape. By the end of the fourth week of gestation the ovum attains the size of a pigeon's egg, and at the end of the second month it is as large as a hen's egg. At that time it consists of a rather thick membrane enclosing a fluid in which floats the embryo proper, which by now has grown to a length of one inch. In the latter one can already distinguish the main parts of the body, the beginnings of ears, eyes, a mouth and nose, and a genital apparatus. The heart is fully formed, and there are the beginnings of all the other inner organs. The embryo is connected with the membrane of the ovum by a cord through which it derives its nourishment. The membrane of the ovum is smooth on its inner surface, but the outer coating, *i.e.,* the surface in contact

with the inner wall of the womb, is covered with numerous tuft-like projections (called villi), which bury themselves in the mucous membrane of the womb. By the end of the second month those villi nearest the point of attachment of the cord branch out and grow to greater length, while the rest of the villi gradually disappear. Thus the ovum lies now free in the womb except for an area at which the cord of the embryo begins. Here, however, the attachment becomes much closer, the mucous membrane of the womb growing thicker in proportion with the growth of the villi; this part is now called placenta or mother-cake (afterbirth).

With the formation of the placenta the growth of the embryo proceeds even more rapidly. At the end of three months the embryo is three inches long and is now called a fetus. At the end of the fourth month the fetus reaches a length of five inches, and at the

Human embryo at about three weeks, showing the beginning of some definite formation of parts. 1, amnion; 2, lower limbs; 3, umbilical artery, a part of umbilical cord; 4, umbilical cord, enclosing also stalk of yolk-sac; 5, arm; 6, yolk-sac, an early organ of nutrition, largely rudimentary in the human race, which soon shrinks up, with its yolk-stalk, to a slender column of cells in the umbilical cord. The formation of the head at the left extremity of the figure is very apparent.

end of the fifth month it is seven inches long. Its movements within the womb are now so marked as to become felt by the mother, as sudden light tappings against the abdomen, called "quickening." When born at this stage the fetus will live from a few minutes to a few hours. At the end of the sixth month the fetus is about eleven inches long; when born at this stage, it will live from one to fifteen days, but is likely to die owing to insufficient development. At the end of seven months it is fourteen inches long; when born at this stage it will usually die, but may live when placed in an incubator. At the end of eight months it is fifteen inches long; with proper care it will usually live when born at this time. At the end of nine months it is about seventeen inches long, and when born should certainly live, with ordinary care. During the tenth month of pregnancy the fetus reaches full maturity, pregnancy approaches its termination and delivery follows.

Changes Due to the Growth of the Fetus.—These are of two kinds, those affecting the womb, and those affecting the entire organism of the woman. As the fetus and the containing ovum grow in size, they distend the womb more and more. In addition to this the walls of the womb become considerably thicker, its muscle-fibers growing both in length and thickness. The enlargement of the womb can be ascertained by vaginal examination as early as the sixth or seventh week of pregnancy, and becomes visible to the eye after three months, when the womb attains such size that it finds no room in the cavity

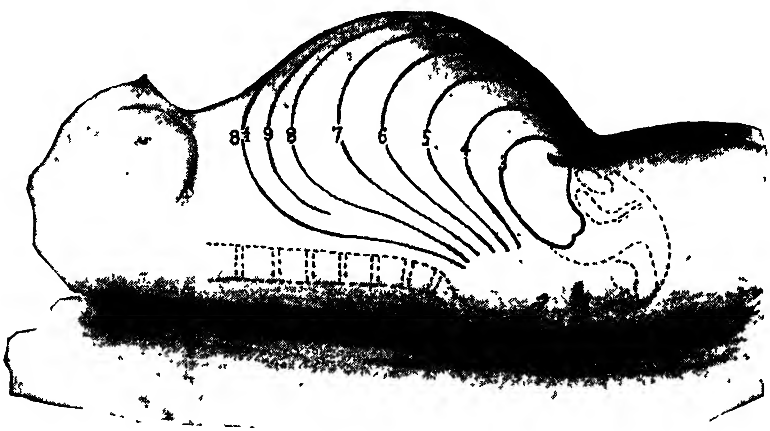


Diagram showing the growth and size of the womb during pregnancy, the curved lines and numbers indicating the outline at the end of the third month, fourth month, and so onward. Between 8½ and 9 months, the womb settles downward somewhat.

of the pelvis but extends upwards into the abdominal cavity. In the next few months the enlargement becomes more and more visible; at the end of the ninth month it attains its maximum, reaching up to the end of the breast-bone and filling out the entire abdominal cavity.

As the weight of the womb with its contents is considerable and the abdominal muscles often are not strong enough to withstand their pressure, the womb frequently falls forward, producing a characteristic protuberance of the abdomen. This position of the womb causes a shifting of the center of gravity of the entire body forward and to correct it as much as possible, the woman instinctively spreads her legs and throws her chest backward, thus markedly accentuating the lumbar curve of the spine. In this manner the whole body assumes a very characteristic, though not very esthetic attitude.

Naturally a body as large and heavy as the pregnant womb will press upon the neighboring organs and interfere with their function. Pressure upon the bladder will irritate it and cause a frequent desire to urinate. Pressure upon the lower part of the bowel will cause constipation. Finally, pressure upon the large blood-vessels carrying the blood from the lower extremities will cause stagnation in the circulation of the latter, often leading to the formation of varicose veins.

Aside from these purely mechanical effects of pregnancy, the presence of the living fetus causes other, even more important changes, in the organs of the mother. The fetus requires for its life and growth nourishment which it derives from the mother's blood; on the other hand the fetus produces waste matter which is deposited in the blood and enters the mother's circulation, to be finally discharged through her urine. Thus two of the mother's most vital organs are compelled to perform extra labor: the heart to pump blood sufficient for the maintenance of life of two individuals, and the kidneys to excrete their waste materials.

Again, knowing the close relation of heart and lungs, one can easily understand that increased heart action causes increase in the circulation of the lungs, with a tendency to attacks of congestion and colds (bronchitis).

The reader who has followed this description, undoubtedly realizes that pregnancy is not a simple matter, that its changes are many and far reaching. In fact, the whole organism of the pregnant woman must undergo some modifications to adapt itself to the new condi-

tions. Nevertheless, in the vast majority of cases, these changes come about so naturally and cause so little discomfort, that we are safe to assure the pregnant woman of a happy termination of her pregnancy, provided she was in good health before conception and leads a natural life during pregnancy and thereafter.

Management of Pregnancy.—The proper management of pregnancy begins long before conception. The woman who has been living a natural life before conception and has therefore preserved a strong and healthy body, may expect less difficulty during pregnancy and childbirth, than would be the case otherwise. Such natural mode of life is recommended elsewhere in this work, where proper rules for outdoor life, rest and exercise, diet and personal hygiene are given. These rules include in particular also strict sexual continence unless offspring is desired.

But even the woman who before conception has not been a follower of the teachings of physical culture may do a great deal toward a comfortable pregnancy and comparatively easy childbirth, by adopting the principles we advocate.

The diet in this condition is of utmost importance. Do not be misled by the ill-advice "to eat for two." Overeating is harmful at any time, but it is most harmful at a time when the kidneys are forced to perform extra labor. Remembering this the woman will live on a simple diet, which will consist chiefly of milk, cereals, fruits and fresh vegetables. One to two quarts of water should be drunk during the day. Meat is best avoided altogether, and if taken, must not be eaten more than once daily and in small quantities. Rich, indigestible food and alcohol should be avoided, the use of coffee and tea should be restricted.

The kidneys demand constant supervision. The urine should be examined at regular intervals, and at the first appearance of albuminuria a strict milk diet should be followed.

The prompt relief of the bowels and bladder before retiring and immediately upon rising is most necessary.

Moderate outdoor exercise is very beneficial. Walking, driving over smooth roads, flower and vegetable gardening are recommended. Attending to household duties is advisable. No exercise, however, should be carried on until fatigue sets in. Sea voyages, horse-back riding, dancing, lifting, straining, working the sewing machine (by foot) must be avoided.

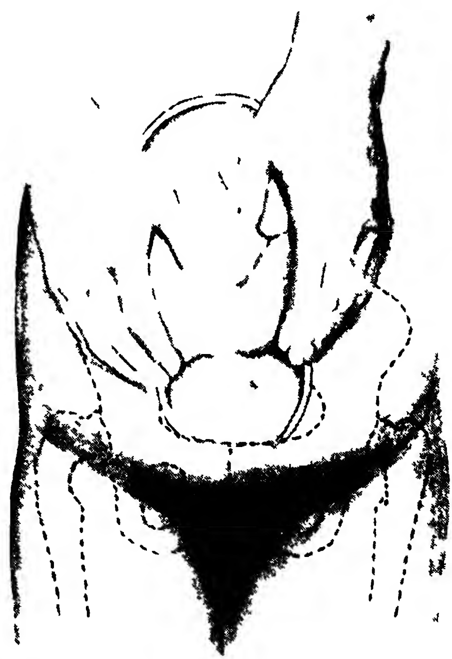
Rest as well as exercise is essential for the pregnant woman. Owing

to the close connection between the mother and her unborn child every unnecessary strain on the nervous system of the mother is communicated to the impressionable nerves of the child This accounts for much of the excitability of some children and their predisposition to nervous diseases. The woman should therefore be protected from unnecessary excitement and worries She should get an abundance of sleep and should best not indulge in sexual intercourse

The clothing worn should be appropriate. Strings and waistbands must be avoided, and instead the clothes should be suspended from the shoulders Clothing suspended from the shoulders, for instance, is advocated for all occasions, but during this period the advantage of such arrangements is infinitely greater, and thus more important.

It is better to avoid anything that even remotely suggests the corset, but if one insists upon wearing something of the kind for the sake of supporting other garments and hose, a corset waist that is without steels or whalebones may be used. This is buttoned down the front and laced at the sides so as to permit of indefinite enlargement to conform to the growth of the body, and the garters are suspended from the sides and front. It should fit loosely

The only form of garter or hose supporter to be used in other cases is one that hangs from the shoulders, and this may be made very readily by any competent woman or purchased complete as may be convenient. It may be made of webbing one inch wide,



Palpation or manual examination with both hands, locating head of fetus with the fingers. Such an examination must be performed with the patient lying down and relaxed.

with ordinary elastic hose supporters attached half way down. The best plan is simply to place the webbing upon and around the shoulders and pin it to fit, after which it may be sewed to assume its finished form.

In the way of underwear, combination garments are especially advocated, thus avoiding any constriction at the waist from drawers or petticoats. One may use a combination chemise and drawers, and a combination corset-cover and petticoat. In buying underwear, it is well to secure garments larger than usually worn, to allow for the enlargement of the body and especially the increasing distance from the neck down. In summer, naturally, the least worn the better. Women pregnant in winter are sometimes advised to wear a woolen union suit covering the body from the neck to the feet, thus maintaining warmth without the necessity of a great deal of heavy clothing to bind and press upon the person. Woolen fabric next to the skin, however, is usually not desirable, and it may be better to wear first a thin cotton or linen union suit, and over this a moderately light one of wool.

The shoes to be worn during pregnancy should be ample and comfortable, whether there is any swelling of the feet and ankles or not. High heels, an abomination at any time, are especially injurious during this period, inasmuch as they disturb the normal poise of the body and involve an unnecessary strain. The flatter the heels and the nearer one comes to the position of the foot as Nature intended it, the better.

As to external clothing. The kimono, in various forms, may be commended as an appropriate house garment during pregnancy. The general principle to be observed in dresses is the one-piece idea, avoiding the waist line and hanging from the shoulders. In all dresses and coats it is always well to choose garments that tend to balance the figure at the top. The lack of a collar gives the undesired "barrel shape" and results in too much prominence of the waist and hips.

The breasts must not be pressed upon by the clothing. When heavy, they may be supported by an appropriate band. If the nipples are flat or drawn in, they must be drawn out between the fingers daily during the latter months of pregnancy.

To correct the unsightly appearance, the muscles of the back and abdomen must be brought into action. By exercising a little care in holding herself in a correct position, the sagging of the small

of the back and the protrusion of the woman's abdomen can be avoided.

Frequent warm tub baths with an abundant use of soap promote excretion by the skin and are very beneficial. They are best taken at night. A cool sponge bath in the morning is also recommended. Very hot or very cold baths should be avoided.

These rules will assure the best possible conditions for gestation and ameliorate, if not entirely banish, the uncomfortable and distressing symptoms which usually accompany pregnancy and weaken both mother and child.

Illness During Pregnancy.—See *Intercurrent Diseases,* a few pages later.

Morning Sickness.—While the morning vomiting which occurs in many cases of pregnancy is regarded as natural, it can be greatly relieved by following the diet recommended in a later paragraph for constipation.

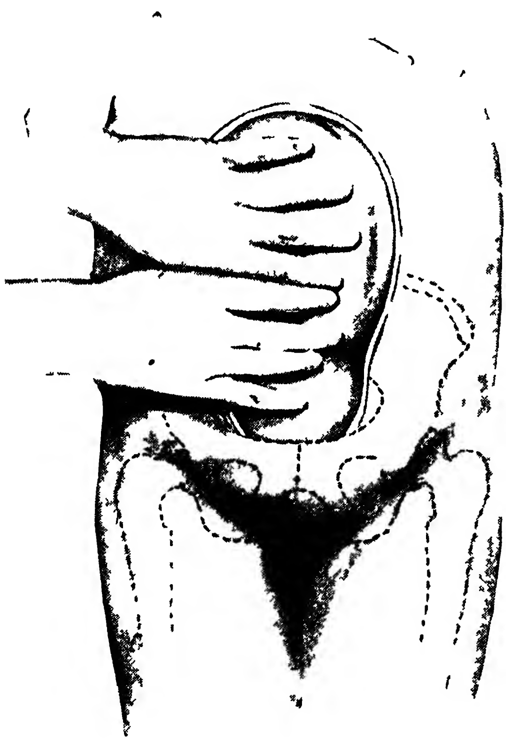
This complaint is often caused, or aggravated, by sexual intercourse during pregnancy. By avoiding overeating and following a healthful diet in general, as advocated in other parts of these volumes, symptoms of this kind should be eliminated. It is usually better in such cases to eat your heartiest meal at noon, and use fruits or green salads at your evening meal. Heavy foods are best avoided altogether. In some cases it is best to use acid fruits alone at the evening meal. This will insure a good appetite for breakfast the next morning. Frequently a bit of dry bread, a prune or any such appetizing food that you can take in bed before arising in the morning will immediately remove any tendency to morning sickness.

A fast now and then, followed by a restricted diet for a day or two, with a gradual return to the full diet will be very efficient. Washings of body with cool water and a general invigorating régime will often prove beneficial.

Disorders Incident to Pregnancy.—While pregnancy is as natural as growth and should be conducted and terminated as safely as digestion, there are many women who have more or less serious disturbances during pregnancy, as a result of weaknesses and disorders, usually from wrong living. Constipation frequently is a health-disturbing condition, but the bowels must be looked after carefully, that this condition may be prevented or corrected. There should be regular exercise before pregnancy, and throughout this period in most cases. Usually more water should be drunk. The diet should be

mainly of natural, uncooked foods, not only for their effect upon the bowels but for the sake of the mother's bones and teeth and general health, and the health and vitality of the developing child.

A frequent meal or at least an occasional meal should be made of nothing but ripe or juicy fruits, and others of raw salad vegetables alone. Berries and melons are laxative, and excellent. Raw flaked or cracked grains may be used advantageously, with rich milk or cream, with or without sweet or soaked dried fruits. In some cases the cereals may be soaked for a few hours, though the mastication required by unsoftened grains will be of value to the teeth, digestion and bowels. Among the cooked foods that are laxative are apples (baked or stewed), stewed dried fruits, especially figs and prunes, spinach, greens, boiled whole wheat and unpolished rice, and whole grain products. Buttermilk and clabbered milk are more laxative than sweet milk, though the latter should not prove so constipating as to counteract the effects of raw and laxative cooked foods if these are taken in sufficiently large amounts for the general health requirements.



With the prospective mother in recumbent position, one may engage in palpation or manual examination with both hands laid flat, in this case locating the size of the womb and the back of the fetus.

The bladder irritation due to pressure of the pregnant uterus can be much relieved by frequent warm baths, and the avoidance of tea and coffee. Serious kidney diseases are apt to develop in women who have not kept up the strict

diet regulations. For this reason we recommend frequent urine examinations. The appearance of the slightest trace of albumen in the urine should be considered seriously, and a strict milk diet should at once be instituted, if the woman is to be spared the dangers of Bright's disease. Sometimes, however, an apparently healthy woman will be suddenly seized with convulsions, the first indications of a disturbed kidney function. This grave condition, called *eclampsia,* usually occurs during the last few months of pregnancy or during labor, rarely shortly after labor. Heroic measures of treatment are required. Pregnancy should at once be terminated, and the fetus extracted with as much dispatch as possible.

Many women are troubled with swellings and varicosities of their lower extremities. These can be relieved by regular massage, and later by the application of a flannel bandage. In more severe cases, the wearing of elastic stockings may become necessary. Constipation must be prevented.

Miscarriage.—It is estimated that about one in eight pregnancies does not go to full term, but ends in a premature expulsion of the unripe ovum. When this occurs at any time before the end of the third month, we term it an abortion; between end of third and beginning of seventh month it is called miscarriage; and after this premature labor. The causes of abortion are various. In some excitable women the uterus is so irritable that the slightest disturbance, whether mental or mechanical, will produce an abortion. Usually, however, death of the ovum precedes it and is the cause of abortion. The death may be due to a disease of the father (for instance, syphilis), to disease of the mother, to disease of the fetal membranes, or to accident. Approaching abortion is manifested by severe pain in the pelvis, which is followed by more or less hemorrhage. The blood usually appears in clots, and may contain particles of the ovum, or the ovum is expelled as a whole. As soon as the ovum has been expelled, hemorrhage and pain cease, and the woman recovers rapidly. To prevent abortion the woman should avoid all excitement and such physical exercise which is connected with a sudden jolt or jar of the body, or exercises which cause an increase of abdominal pressure, such as lifting heavy weights. When abortion has set in, rest is of no value. On the contrary, the woman should be encouraged to be up and about, unless the hemorrhage be too copious. Frequently abortion terminates favorably without any interference. Sometimes, however, when bleeding is protracted or severe, medical attention is necessary.

Extra-Uterine Pregnancy.—In some, fortunately very rare cases of pregnancy, the impregnated ovum, for cause unknown, finds lodgment and begins to develop in some part of the abdominal cavity outside the uterus, usually in the tube, sometimes in the ovary, or more rarely, in some other part of the abdomen. The resulting condition is called extra-uterine pregnancy. During the first few weeks of extra-uterine pregnancy nothing unusual will occur. There may be cessation of menses, vomiting, and all the other early symptoms of pregnancy. The ovum will proceed in its development until about the end of the second or beginning of the third month. At that time the woman usually begins to complain of sharp shooting or drawing pains in her abdomen and lower extremities. These, however, may be entirely absent. Very rarely the ovum proceeds in its development until full term; in such case labor pains will set in, but of course labor does not take place; instead the ovum bursts and a profuse internal hemorrhage follows. Usually, however, an extra-uterine pregnancy ends at some time between the third and sixth month of pregnancy in one or two ways: either the fetus dies, the liquid of the ovum is slowly absorbed, and the fetus changes into a dry tumor, or the ovum bursts and causes an internal hemor-

A breech presentation, more unusual and also more difficult to manage than a head presentation.

rhage. Such occurrence is marked by a sudden and very severe abdominal pain and collapse. As the organism cannot rid itself of the ovum without outside help, surgical treatment should be instituted as soon as the condition is recognized.

Intercurrent Diseases during pregnancy are apt to have an untoward effect upon the latter. Febrile diseases, such as grippe, pneumonia, typhoid or scarlet fever, may cause death of the fetus with resulting abortion.

Women suffering with heart disease will require special attention during pregnancy. We have seen that even the normal heart has extra labor to perform in pregnancy. Where the heart is diseased at the outset, it may not be able to respond to this demand and symptoms of heart failure may follow. This may be guarded against by the avoidance of all sudden exertions and by vitality-building.

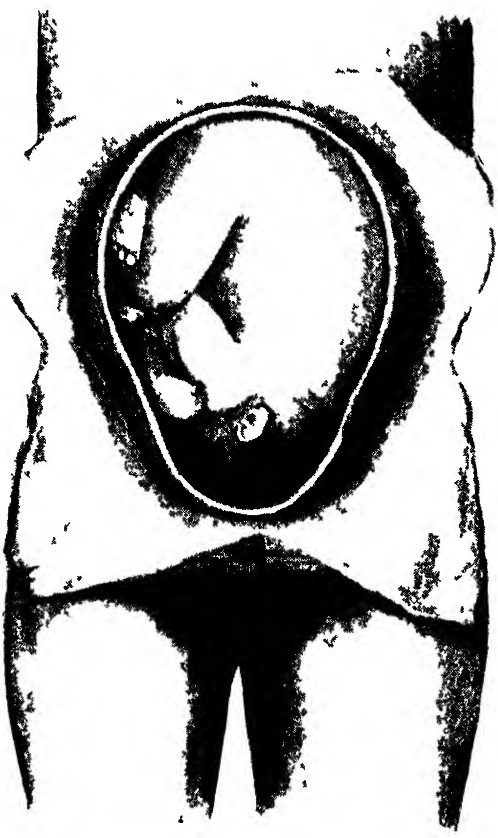
In women afflicted with chronic lung disease such as bronchitis, emphysema or asthma, the disease will often become aggravated by pregnancy. Tuberculosis of the lungs almost always advances very rapidly during pregnancy, and especially during the period following childbirth, and often becomes fatal. Women afflicted with pulmonary tuberculosis should therefore under no condition become pregnant.

The question of the general treatment of illnesses during pregnancy by fasting and other vigorous natural methods is one that will often arise. Sickness at this time should be treated the same as at any other time, and if physical culture methods are used it will not last long. The unusually active function of the body at this time will very quickly overcome disease if conditions permit.

Labor.—About forty weeks, or, less exactly, nine solar months from the period of conception, the fetus reaches full maturity and labor begins. Labor is usually divided into three stages. During the first stage the neck of the womb becomes slowly and gradually distended and the orifice of the womb opens widely. When these changes have about reached their limit the fetal membranes burst and the liquid surrounding the fetus (amniotic liquid) escapes. This ends the first stage. During the second stage the fetus is born. After birth of the fetus the placenta is expelled from the uterine cavity. This constitutes the third stage of labor.

The first stage is usually ushered in by a sensation of more or less sharp radiating pains in the abdomen, accompanied by a dull pain in the small of the back and a drawing pain in the thighs. Women giving birth to their first baby may feel these pains weeks in advance

of the actual onset of labor They are at first very short in duration and occur at long intervals, but gradually become prolonged and frequent; we speak of good pains, when each lasts about one half to one minute and when they occur at intervals of about three to five minutes The pains are due to a cramp-like contraction of the muscular body and upper part (fundus) of the womb, forcing its contents downward As the contents are at least in great part liquid, the effect is similar to that produced by pressure upon a rubber bag filled with fluid· the weakest parts of the walls will give in and distend to their limit. Thus the walls of the neck of the uterus become thinner and thinner, first the inner, then the outer orifice of the neck opens, and the fetal membranes protrude through the gaping orifice Finally these can not withstand the pressure of the amniotic liquid any longer and rupture The liquid escapes and the part of the fetus nearest the orifice, usually the head, enters it The average duration of the first stage of labor is six hours, but it may last twenty four hours or longer, depending on the muscular action and upon the rigidity of the cervix



Normal position of the fetus in "head presentation."

During the last few months of pregnancy the fetus has assumed a fairly permanent position Owing to its floating in a liquid medium it settles with its heaviest part (head) downward, and when the membranes

burst at the end of the first stage of labor this part enters the orifice. It is said to have engaged in the orifice. Now the contractions of the womb become even more intense and the head is forced out of the womb into the bony canal of the pelvis, lined by the vagina, toward the vulva.

As the head proceeds on its course, it begins to press on the rectum, causing a desire to defecate. The muscles of the abdominal region now come into play, and by contracting at each pain help to express the fetus. Soon the fetal head (scalp) begins to show with each pain in the entrance of the vagina. The on-moving head now rests on the soft tissue between rectum and vulva (the perineum). The latter stretches under the enormous and steady pressure; at the same time the head slowly turns upward and after a few strong pains, the largest diameter of the scalp enters the vulva, the face resting now on the perineum. With the next pain the perineum slips over the face and the head is born. After another minute or two the rest of the body follows. The new-born babe is still connected with its mother by a pulsating cord, but under the stimulation of the cold air it begins to breathe and the pulsation of the cord ceases. The cord is now tied and cut. This ends the second stage of labor. It usually lasts about two hours or more.

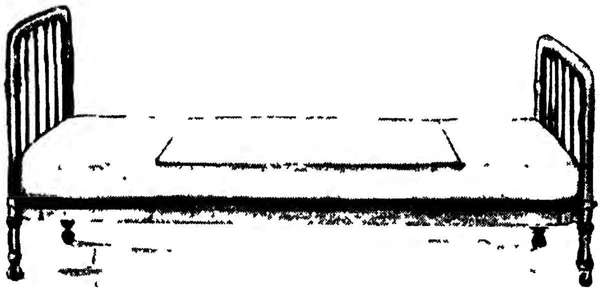
In a normal case of labor, the womb now contracts into a round, hard mass. An interval of rest, lasting about one-half hour, follows, during which the woman partly recuperates her forces. Meanwhile the placenta becomes detached and when the pains set in again, a few contractions usually suffice to expel it with all the membranes. This terminates labor.

The exhausted woman now sinks into a deep, wholesome sleep, from which she wakes refreshed in a few hours.

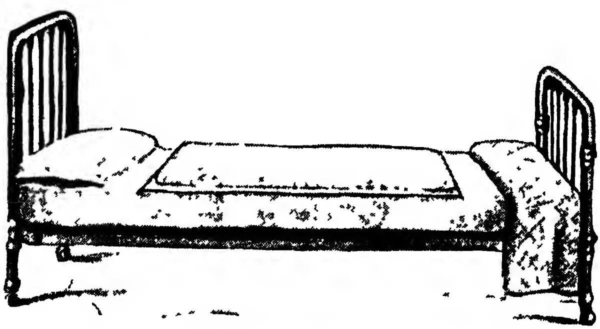
Management of Labor.—We now come to one of the most important phases of our subject. What should be done when labor is imminent and during labor? In the first place a person well versed in the management of such cases should be engaged in ample time before the onset of labor. Of course we would recommend a practitioner who is a believer in natural methods, but where such is not obtainable a regular midwife or physician must by all means be engaged.

Having done this, the woman will naturally turn her cares to the preparation of the various supplies needed in labor. The following list represents the minimum of supplies required and will serve as a

Preparation of Childbirth Bed. No. 1.—The large rubber cloth is first spread over the mattress and fastened with safety pins.



Preparation of Childbirth Bed. No. 2.—The large rubber cloth is then covered by a large sheet which is well tucked under the mattress as shown here, after which the smaller rubber cloth is placed across the center of the bed, on top of this sheet.



Preparation of Childbirth Bed. No. 3.—Finally, on top of this second small rubber cloth is placed a large absorbent pad, as shown here. A draw sheet may be placed over the small rubber cloth and under the pad, if desired. To this is added a flat soft pillow and a suitable clean covering placed in readiness across the foot of the bed.

guide: Two or more cakes mild Castile soap; boracic acid; a new, large, coarse sponge; a fountain syringe (sterilized); bed-pan; a sterile glass catheter; one pound of absorbent cotton; small bottle of carbolized vaseline; 1 dozen towels; large rubber cloth (2 yards by 1½ yards); small rubber cloth (1 yard square); unbleached muslin for abdominal binder (2 yards); sterile gauze (20 yards); plenty of old, clean linen, sterilized by baking in oven; large and small safety pins (2 doz. each); fine, soft sponge; talcum powder; castile soap; several changes of baby's clothes; soft pillow; two flannel bands for baby; diapers (4 doz.).

The sterile gauze and cotton serve to prepare two or three large absorbent pads and several dozen small occlusive pads. The large pad consists of several layers of cotton, two to three feet square and two to four inches thick, covered with gauze and loosely quilted. The occlusive bandage is made by enclosing two thicknesses of cotton seven or eight inches long and four or five inches wide in one-fourth of a yard of gauze, so folded as to make a pad sixteen or eighteen inches long and four or five inches wide, the edges being stitched. All pads are wrapped up in paper and baked, and kept sterile until required.

With the first sign of approaching labor the physician in charge is summoned, and he having ascertained that labor is in progress, a rectal enema of one pint of salt water is administered. If there be time, the woman takes a warm bath with soap. In any case her external genitals are thoroughly washed. She may now remain on her feet and walk about, comfortably dressed, resting occasionally and taking light nourishment.

Meanwhile the bed is prepared by the attending nurse. An airy, warm room is selected. The bed should preferably be narrow and high, with a firm mattress. It is placed so that it can be approached from all sides. The rubber sheet is stretched over the mattress, fastened with safety pins and covered with a sheet which is well tucked around and under the mattress. This constitutes the permanent bed. The temporary bed consists of a draw sheet and the small rubber sheet underneath. On top of the small rubber sheet and draw sheet is placed a large absorbent pad. A soft, flat pillow at the head and a sheet or an old but clean blanket to cover the patient complete the outfit. A chair is placed at the foot of the bed. On the floor, which is covered with oilcloth or thick paper, a pail is placed to receive the waste. On a small table within easy reach is placed a tube of vaseline, a half-dozen towels, a large sponge, a pair of sterile scissors and sterile silk tape and a basin filled with a sterile solution of boric acid, containing several dozen pledgets of cotton.

The woman is usually encouraged to remain on her feet until the external orifice of the cervix has dilated to about the size of a silver dollar. Where the pains are not strong, it may be to her benefit to stay up longer. As soon as in the judgment of the attending physician the bag of waters threatens to rupture, the patient is placed in bed. A premature rupture of the fetal membranes must be guarded against as much as possible, as an escape of liquid at an early stage means a

difficult and prolonged labor, which is commonly known as "dry labor." Usually the membranes burst when the orifice is fully dilated; the large sponge is held in readiness to catch the outflowing liquid.

During the second stage of labor the patient must by all means remain in bed; and during the latter part of this stage she is uncovered. The pains now change in character from cramp-like drawing pains in abdomen, back and thighs to bearing down pains.

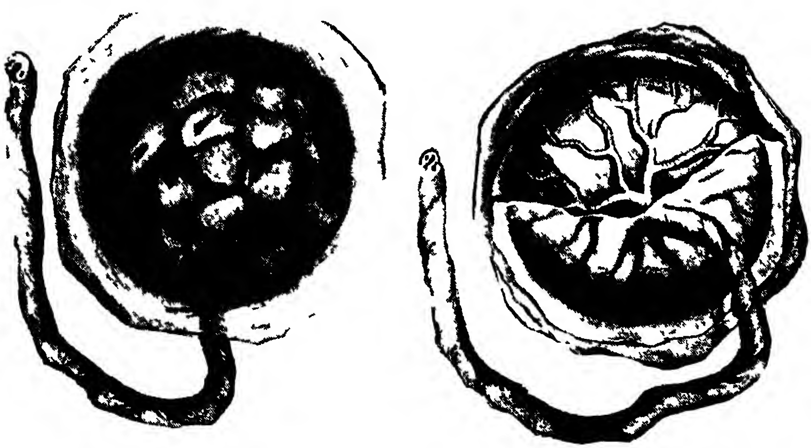
One of the most important features associated with easing delivery is frequently ignored. With the onset of each pain during this stage of labor, the lungs should be filled to their greatest possible capacity. Draw in as much breath as you possibly can with each inclination. This one suggestion if closely adhered to will greatly increase your ability to "bear down" and thus insure an earlier delivery. The air is suddenly expelled and after a deep inspiration the pressing is again resumed, to be continued until the pain ceases. This is repeated with each pain. Some help can be derived from a roller towel tied to the foot of the bed, by letting the patient pull at it during a pain. The head descends now lower in the pelvis and presses on the rectum. An intense desire to empty the bowel may be felt by the woman. Under no condition must she now be permitted to leave her bed in order to gratify this desire. If any pieces of fecal matter appear at the anus, they are wiped away by a pledget of cotton and thrown into the pail. Soon the vulva begins to gape and the scalp of the fetus begins to show. This occurs with each pain, but gradually more of the scalp appears.

After about thirty minutes or more the perineum is stretched to its utmost and the scalp becomes fixed in the vulva. Great care must now be exercised to avoid a serious tear of the perineum. Among savage women the perineum is more elastic, while the baby's head is small. But even with a less elastic perineum of the woman and in spite of the larger brain and head of the baby in our civilized condition, a serious tear can be avoided, provided the woman has passed through a normal pregnancy and expert help is present at her bedside during labor. A tear of the perineum may occur because the head advances too rapidly and the perineum has no time to stretch to its maximum. It can, therefore, almost always be prevented, if at the critical moment the woman is warned not to press, and the fetal head is retarded for a few pains by pressure of the hand. Simultaneously the other hand rests on the perineum and pushes the head forward toward the symphysis. This procedure, which relieves the perineum of much pressure, is usually called "supporting the perineum." With

proper support of the perineum the head is born with but slight or no laceration. At first pale, the new-born head soon turns blue and almost livid. Nevertheless there is no immediate danger to the fetus, and it is best not to interfere with the further natural progress of labor. Slowly the head turns with its face toward one of the thighs. With the next pain the neck and the shoulder nearest the symphysis appear, then the shoulder resting on the perineum rolls out and is immediately followed by the rest of the body. The new born baby announces its arrival with a lusty cry It is placed on its right side, with its face turned away from the mother, care being taken that the cord is not stretched tight. As soon as the cord stops pulsating it is tied secure about two inches away from the baby's abdomen and cut a little above the ligature The other end of the cord need not be tied. The baby is now wrapped in a warm blanket and put in its crib

Immediately after the baby is born the attendant places his hand on the woman's abdomen and compresses the womb, kneading and rubbing it occasionally in order to secure complete contraction and to prevent a hemorrhage. About one-half hour after completion of the second stage of labor pains set in again, and after a few minutes the placenta is expelled and caught in a prepared vessel by the attendant.

This completes labor. The woman's genitals are now washed with clean, sterile water and covered with an occlusive bandage, the tem-



Two views of the placenta. To the left the under surface, or maternal surface, and to the right the upper or fetal surface with the umbilical cord and the membrane partly removed to show distribution of blood-vessels.

porary bed is removed and a binder and pad adjusted about her abdomen.

Menstruation During Pregnancy occurs in rare cases only. (See *Menstruation.*)

Most Common Irregularities of Labor and Their Management.—In some, fortunately rare cases, labor does not take the natural course, described above, but is in one or more respects irregular.

Of all irregularities, a protracted labor, due to deficient pains, is the most important and the most common. While the usual duration of labor is from six to eighteen hours, it may in such cases be prolonged to twenty-four or even forty-eight hours, and will sometimes require surgical interference for its termination. Deficient pains are more common in women who have given birth to several children in rapid succession than in young women during their first childbirth. The condition is the result of a weakening of the uterine musculature, but may sometimes be simply the expression of nervous excitement. The best possible prevention is a regular life during pregnancy. When deficient pains do occur, a complete rest and reassuring the patient that there is no cause for anxiety will often help. In extreme cases the application of forceps becomes necessary.

Labor is sometimes much delayed by a lack of proportion between the dimensions of the child's head and of the parturient canal, *i.e.,* either the canal is too narrow or the head too large. Of the two, the first abnormality is more common. Usually we have to deal with some deformity of the pelvis, through which the latter has become contracted in one or more of its diameters. Deformities of the pelvis are sometimes due to a general underdevelopment of the woman's skeleton, more often they are the result of a disease of the bones of the pelvis (rickets, osteomalacia), or a disease of the spinal column (hunchback) or of the hip-joint. The management of labor in a case of contracted pelvis is very difficult. When the child is of normal size or perhaps slightly undersized, and the deformity slight, natural birth will often take place in spite of the deformity. In more advanced cases the physician will usually be obliged to help the natural forces by either applying forceps or by performing version. The first operation consists in introducing a two-bladed instrument (the forceps) into the uterine cavity, grasping the head between the blades of the instrument and pulling on it until the head is born. Naturally the application of the instrument as well as the method of extraction require considerable skill. The operation of version consists in introducing

the sterile hand into the uterine cavity, turning the child and extracting it by its leg.

In some very rare cases the pelvis is so narrow that neither of the above operations is available. Here sometimes it is possible to help the mother by inducing labor after thirty-six weeks of pregnancy, when the child's head has not yet reached its full size. When even this procedure is impossible, Caesarean section becomes necessary. This operation, thus named because Julius Caesar is reputed to have so come into this world, consists in opening the mother's abdomen and womb and removing the child through the wound.

Sometimes the difficulty of a narrow birth canal is not due to a deformed pelvis, but to some abnormal condition of the soft parts, such as a very rigid cervix, or a tumor lying in the pelvis and pressing on the vagina, or some other similar condition. In all such conditions quick action on the part of the attending physician may be required, and will usually result in successful labor.

In case the labor is delayed by a too large child, the methods employed are much the same as in ordinary deliveries. The choice of the method will depend on the degree of disproportion, and must always be left to the judgment of the attending physician. The general principle by which he is guided is to save the life of the mother first and foremost, and do her as little harm as possible. The life of the child is of second consideration, although it will always be his aim to save it if he can do so without endangering much the life of the mother.

Here must also be mentioned the rare condition of increase in the size of the child, owing to malformations, such as development of monstrosities, or to disease, such as hydrocephalus. Monstrosities of various kinds may occur. Usually they consist in the multiple development of some part of the body; thus there may be a child with two heads, or with four arms or four legs. The extreme of this monstrosity are twins joined loosely by the front, side, or back (Siamese twins). Even such cases sometimes are delivered spontaneously, but usually complicated surgical operations will be required.

Where the head of the child is overlarge on account of hydrocephalus, version is usually the required operation with additional tapping of the brain cavity through the spinal canal. Naturally in all cases of monstrosities the surgeon will choose the operation least dangerous to the mother without regard to the life of the baby.

Of other irregularities occurring in the first and second stage of

labor, we must mention placenta praevia. This name is applied to a condition in which the afterbirth finds its attachment near or in the neck of the womb instead of at the fundus. As a result, the placenta becomes detached at a very early stage of labor, and unusual bleeding occurs, which may become fatal unless checked. The treatment consists in packing the vagina tightly with sterile gauze and performing version as soon as the cervix has dilated sufficiently to admit the hand. Where packing does not stop the hemorrhage, the physician will not even wait for sufficient dilation, but dilate forcibly and perform version.

During the third stage of labor we may sometimes encounter cases where the womb shows some sluggishness in its contractions and retains the afterbirth. It is usually possible to assist the woman in such case by external manipulations; the attendant grasps the womb in his hands through the abdominal wall, and by compressing it steadily, is able to express the placenta. Sometimes, however, the attachment of the placenta to the inner wall is so close that the above method will not suffice to express it. In such case the physician must introduce his hand into the uterine cavity, and by gentle manipulations of his fingers, sever all adhesions, when he will be able to remove the entire placenta.

After the uterus has been emptied of all its contents, it usually contracts firmly into a solid, hard, round mass. Sometimes, however, the muscle remains flaccid, and as a result, a dangerous hemorrhage follows. The way to prevent it is to stimulate the uterine muscle by friction and cold applications. Where this has no effect, the womb is packed with sterile gauze for twelve to twenty-four hours.

Motherhood in Mature Years.—See *Age, Its Effect on Childbirth,* in the first pages of the present Part.

Painless Childbirth.—Although comparatively painless childbirth is a possibility in some instances, it cannot be made certain in all cases by any means. Much may be done in this direction by following a suitable diet, including considerable uncooked food, an outdoor life, suitable exercise and other conditions which make for the highest degree of health, strength and elasticity of tissue. Probably the most effective immediate measure in this direction is the hot sitz-bath, taken two or three times a week for the last month, and taken for a half hour or more when labor pains begin. The immediate effect is to produce a relaxation of tissues which is favorable to any easy birth. There appears to be a tendency to a larger loss of blood following such a hot sitz-bath immediately preceding birth, because of the dilated condition of the blood-vessels, and it may be wise to avoid the bath

in the case of a weak woman, or one who is known from previous experience to be subject to free hemorrhage. In the ordinary case, however, especially if one is strong and vigorous, there is nothing to fear in this direction, and the birth will be made much more comfortable.

It is not to be expected that civilized women can have such an easy time as the savages, on account of the larger head common in intellectual races. The question depends a great deal upon peculiarities of individual build, for though physical culture methods will reduce the trials of paturition one-half or more, and will make for rapid recovery, yet there may still be some who will have a more or less difficult time. Among those who give no attention of any kind to their health, there is a certain proportion who have a very easy time, in spite of their weakness, because of a favorable build. It is really well to have measurements of the pelvic bones taken by a competent expert in obstetrics.

Massage of the abdominal walls with olive oil will be of much assistance in giving them elasticity and also in preventing the scars which often come with the stretching of the tissues.

Practical Details of Preparation for Childbirth.—Very material benefits in health, comfort and appearance of the pregnant woman can be secured by reducing the amount of body fat during the latter months. This presupposes there is a surplus of body fat to be removed, and the method would not be applicable to a woman who had reached the middle of her pregnancy in a thin condition. But if she is carrying ten or more pounds of fat that can be spared, and this is gradually removed as the child grows in size, distinct benefits are derived.

If such reduction of the mother's weight at this time were carelessly undertaken there might be cause to fear injury to the mother or the child from poor nutrition. But it is quite possible to provide a diet that will reduce the mother's fat and at the same time be actually superior to the ordinary diet for both the growth of the child and the nutrition of the mother at this period. Since the total quantity of food taken is less than usual there is a further relief to the mother by lighter digestive duties and a smaller bulk of material in the digestive tract.

The essential principles of this diet are that it shall contain an adequate, though not excessive, amount of the best growth foods. These are milk and eggs. Not less than one quart of milk, nor usually more

than one and one-half quarts a day should be taken. To this may be added one to three eggs per day.

The other essentials of the diet are: Either oranges or tomatoes; leafy salads; bran or other effective laxative foods to insure good bowel movements and to prevent constipation resulting from the reduced total quantity of food.

To the above essentials any general health foods may be added in such quantities as will either just maintain the total body weight or slightly reduce it—the fat being absorbed as the child grows so that the usual increase of the mother's weight at this time does not occur. Accurate weekly weighings are necessary to the success of the method and if weight is being lost at more than a pound a week the diet should be increased; but if gains are experienced it should be decreased.

A careful measuring of the abdominal girth is an even more accurate way of judging the effects. When the diet is first begun this girth should decrease slightly, owing to the partial emptying out of the digestive organs. Thereafter it should maintain a fairly constant girth until perhaps that last two months of pregnancy when some increase is to be expected, and one should not try to avoid it.

The above system of dieting during pregnancy was worked out by Milo Hastings, Director of the Physical Culture Food Laboratory, and applied in a first pregnancy under conditions promising difficulty. So great was the success of the method that the prospective mother continued in business to the very day preceding the birth of her baby and those daily associated with her were unaware of what was about to occur. Although the mother is a very small woman the baby was of somewhat more than average size.

This method does not produce a particularly small baby; that is neither the object nor the effect, as the baby receives maximum nourishment—but without encumbrance of useless fat. The law of Nature is to care for the needs of the child first, and the result of an effort to produce an unnaturally small child would be to undernourish the mother and injure her vitality so that she could not nurse her child.

Shoes.—See *Clothing*.

Sleep and Rest.—Plenty of sleep and rest will do a great deal for the pregnant woman, for under the circumstances she often finds that she needs even more sleep than during the ordinary course of life. All conditions in the home should be so arranged that she may be able to enjoy all the sleep that Nature calls for. Visitors in the evening who have not sufficient sense to go home at a reasonable hour should

not be tolerated. There are "stay lates" of this kind in every community, and they should be told early in the evening, frankly but without offence, that such and such an hour has been made bedtime for the present on account of the health of the wife and mother of the family. Aside from the mere matter of sleep, there should be plenty of opportunity for rest while awake, such as sitting in the open air for the afternoon. A reasonable amount of work may be kept up with advantage, but continuous overwork in the kitchen and home generally, is exhausting and undesirable.

Swelling of Limbs.—In some cases, swollen limbs and distension of the veins of the legs to the point of varicosity are evidenced in the prospective mother. The treatment of varicose veins under these circumstances should be the same as described in Volume V.

It may be well to have an examination of urine from time to time, especially if there is a swelling of the feet and ankles, or if there are other dropsical symptoms in any part of the body. Such swellings during pregnancy in some instances indicate overworked kidneys, which may give rise to serious complications before or during birth. Uremia, perhaps attended by violent and sometimes fatal convulsions, is the result of the retention in the system of the wastes and poisons that should be eliminated through the kidneys. The preventive and also the remedial treatment is a series of full hot baths for removing these poisons through the pores of the skin. In some cases pressure on the large veins causes swelling of the legs. In a general way it may be said that swellings of the legs should call for hot baths from three to five times weekly, in addition to attention to diet, outdoor air and the other considerations mentioned in the course of this chapter. The water should be from 105° to 112° F., according to the limits of comfort, and should last from ten to twenty minutes, though always getting out of the bath immediately at the first feeling of weakness or unusual discomfort. If the heart seems weak, take a bath at the temperature of the body, or 98 degrees to 100 degrees. A bath thermometer should be in every house. In addition to these baths, dry friction rubs, air baths and the wearing of light clothing will help greatly in insuring the desired activity of the skin.

The Lying-in Period.—During the period immediately following delivery the woman's organs rapidly resume their normal condition and function; at the same time her breasts assume a new function, lactation. Of all these changes, those affecting the genital tract are the most wonderful. The mucous membrane of the womb has prac-

tically all come away during childbirth, leaving a raw discharging surface from which at first blood is oozing steadily. The cervix and vagina, greatly distended and in some cases lacerated in places, produce a discharge of their own, which mingles with the uterine flow. Thus there is a steady flow from the woman's genitals, diminishing in quantity and changing in character as the repairing process advances. During the first few days the woman will usually require six changes of napkins in twenty-four hours. The discharge, at first bloody, becomes serous on the fifth or sixth day and white (healthy pus) two days later. It rarely has an offensive odor. While the mucous membrane is being repaired, the body of the womb goes through a building-down process, by the end of which it resumes its original size and shape. The numerous small rents heal spontaneously. Six weeks elapse before healing is entirely completed.

After delivery the length of time the mother remains in bed depends chiefly upon her physical condition. Ordinarily it varies from five to ten days. It is better to remain in bed a day or two longer. Cleanliness is most essential in her management. The woman's body should be washed daily. Her genitals should be washed several times daily, with sterile water, the hands of the nurse being previously sterilized. During the first few days absolute physical and mental rest are required. Gradually some liberties are granted. By the end of the first week the woman may sit up in bed and after a few more days she may be permitted to rise. The diet should be simple. During the first few days milk and cereals are given, gradually a more varied diet is permitted. There may sometimes be experienced some difficulty in urination. Hot poultices to the bladder may induce urination. If necessary the woman is catheterized a few hours after delivery. One or two days after delivery an enema may be given; after this the woman's tendency to constipation is combated in the usual manner.

The greatest danger of the lying-in period is puerperal sepsis, com monly known as blood-poisoning. Where the condition has developed it will become necessary to institute the general treatment described in Volume II, page 1014, under Puerperal Fever.

By drinking a generous amount of liquids at such times, preferably taken hot or luke warm, this danger can be avoided. Milk diluted with water or an orangeade made like a lemonade, sweetened or otherwise, as desired, water sweetened with honey, or any wholesome drink can be recommended. The idea is to get a large amount of liquid into the system as quickly as possible.

Where the danger is really serious, it is sometimes safer to adopt an exclusive milk diet. This flushes the entire system and even in cases where remnants of the after-birth remain in the womb, this process of flushing the system, as adhered to in the milk diet, will usually successfully and naturally combat this serious danger. After a few days the menacing dead tissue should be ejected from the womb naturally and painlessly. The only objection to the exclusive milk diet in cases of this kind is sometimes noticed in the small quantity of milk that will be secreted for the infant when changing the diet. The mother's life under such circumstances, however, is of prime importance, and the child can depend upon cow's milk for additional nourishment in case this emergency appears.

Blood-poisoning, one of the most serious dangers associated with childbirth, can be remedied in numerous cases by either of the two remedies mentioned above; either the very free use of liquids as previously advised, or by adopting the full milk diet. In twenty-four hours after beginning the milk regimen the most serious symptoms of blood-poisoning that sometimes follow childbirth often abate and within forty-eight hours thereafter the patient may become normal.

In some cases where the quantity of milk prescribed cannot be taken, it may be necessary to give some additional nourishment in the form of an evening meal. In other words, milk could be taken until two or three o'clock and then a regular meal could be eaten in the evening, suitable to the appetite and requirements of the patient. Or a noon meal could be eaten, drinking milk in accordance with the milk diet régime, until say nine or ten o'clock in the morning, taking the midday meal about one o'clock, beginning the milk diet again at about four or five, guarding carefully against constipation.

The Care of the New-Born Child.—It sometimes happens that the new-born child is asphyxiated, *i.e.*, does not breathe. Quick action is then required. The assistant takes the physician's place at the mother's bedside. The physician lifts the baby by its feet to facilitate the escape of mucus from the trachea and throat and cleans the throat of mucus with his little finger. He then tries to resuscitate the baby by a few sharp taps on shoulder and buttocks. If unsuccessful he at once begins artificial respiration. Next, the child is placed in a basin of warm water and a stream of cold water thrown on its chest. If necessary the procedure is repeated several times. The physician, having delivered the woman of her placenta, returns to the baby. He first examines the cord and, if necessary, reties it. Next the baby's entire

body is wiped with a soft sponge dipped in warm olive oil. The child is then thoroughly examined to ascertain the presence of any injuries or deformities which might require immediate treatment. A drop of 1 per cent. solution of silver nitrate now is instilled in each of the baby's eyes. The cord is wrapped up in sterile gauze, after which the child is diapered and loosely wrapped in some light but warm covering, and permitted to sleep several hours. Subsequent care of the infant is given in the following Part.

PART 16

THE CHILD AND ITS CARE

THE first rule to be followed after the arrival of the new-born infant is to do as little as possible. The first care has been outlined briefly in preceding, in connection with the management of childbirth. The ordeal of birth is a somewhat exhausting one, and, after having the cord cut and attended to, the first thing the baby needs is, not a bath, but a good, undisturbed sleep. Attention to the cord and the navel should be given according to the instructions given under *Navel, Care of,* in this section, and instead of the immediate bath it is better to apply olive oil all over the skin of the little body. Then either dress or wrap up in a soft flannel blanket, and put to bed for a sleep, covering sufficiently for warmth.

Various subjects connected with the care of the baby are taken up in alphabetical order, though for immediate reference following the birth we would call early attention to the instructions on *Bathing, Feeding,* and *The Care of the Navel.* However, all subjects connected with the care of the baby are of great importance, and one should not neglect the suggestions in regard to sleeping, clothing, exercise, premature children, diseases of infancy, attention to bowels, mouth, eyes, ears, nose and the various other matters taken up here.

Air.—If fresh, pure air is important at any time of life, it is especially so in infancy, although it once was the general custom to keep babies confined in warm houses in the winter time and covered with veils when taken outdoors. In the rapid growth and great cell-activity of infancy, the supply of oxygen is a vital matter. The windows should always be open, even though it may be necessary to burn a greater amount of fuel in order to keep the fresh air warmed in winter. And especially should the baby be kept outdoors as much as possible, not only for airings but as a matter of everyday living. In fact, one should try to make some satisfactory arrangements for having the little one sleep outdoors altogether wherever this is possible.

Air-baths are recommended whenever the temperature will permit; they not only strengthen and toughen the little body, but favorably in-

fluence the respiratory function of the skin and invigorate the nerves. (See under *Bathing*.) In severely cold weather, however, sufficient clothing and bed covering should be used to maintain normal warmth, the test for this being warm hands and feet. Both clothing and bed coverings should be light and loose, woolen blankets and down comforters being lightest and warmest for the latter purpose. If necessary, when sleeping outdoors in winter, hot-water bottles or heated bricks may be used to keep the little bed warm.

Nurseries should be well ventilated, but it should be remembered that the ideal nursery, indeed, the only proper nursery for any child, is the great outdoors, green and sunshiny in summer, or white and fresh and bracing in winter.

Bathing.—*The first bath* of the newly born infant is a matter of some importance. In the past it seems to have been the general custom to "wash" the baby immediately after birth. This may be a fairly satisfactory proceeding in the case of most vigorous infants, but it is usually a better plan to allow the child to have a good sleep before the first bath. In his journey into the world the baby has had a strenuous and exhausting trip, and is in need of a rest before his bodily energies are subjected to the necessity of recuperating from a bath.

It is well to rub olive oil over the skin of the entire little body the very first thing, and especially should this be done if the skin is covered in part by the cheesy deposit known as the *vernix caseosa.* After this the child should be diapered, and may be wrapped in a very soft flannel cloth or blanket, without the need of immediate dressing, and put down to sleep, wrapped and covered warmly. This olive oil may be applied after the sleep and before the bath, in some cases, but if there is any of the vernix caseosa on any parts of the body the oil will be of great help in removing it, and should be applied as soon as possible. Lard may be used for the same purpose, and is very effective. This cheesy matter mentioned may be entirely absent in many healthy babies, or it may be found chiefly around the joints, on the head, or even over a large part of the body. It should be very thoroughly removed, if present, for otherwise it may later cause irritation and inflammation.

The bath should preferably be warm, or of the temperature of the body, and should be given in a fairly warm room. Bodily warmth is an important matter for the baby during the first few days. Even an ordinary bath will usually lower the bodily temperature of the infant in slight degree, and there are only a few pounds of flesh there alto-

gether in which to generate the heat to resist and recuperate from the bath. A cold bath may prove to be a severe tax upon the young organism. "Remember that the baby comes from a warm place," as our grandmothers used to say, and that the temperature of the ordinary living room is itself perhaps twenty-five or thirty degrees cooler than the surrounding temperature of the mother's body to which the little one has been accustomed.

The temperature of the room for the bath should be from eighty to eighty-five degrees. The water for the bath should be of the temperature of the body itself, or from 95° to 100° F. It is advisable to secure a bath thermometer in order to make certain of the right temperature. It will cost very little, and will be of value for general service in the household as well as for gauging the baby's bath. It will be of service in determining the temperature of an enema or douche, as well as being advantageous in various forms of the hydrotherapeutic treatment detailed in Volume IV. But if you have no such thermometer, do not try to test the temperature with the hands. Use the elbow to determine quickly if the water is too hot.

Before proceeding with the bath, one should have everything to be used conveniently at hand, including all of the garments to be put on afterward. The thermometer should be placed in the water before-

The child's bath is an important adjunct to its healthful growth and development.

hand, so that it will have time to register accurately. Only a pure Castile soap should be used, never the perfumed or fancy varieties. A soft sponge may be used, but the difficulty of keeping it strictly clean and sanitary is such that a square of soft linen cloth is to be preferred. Soft old towels should be used, or what is better yet, pieces of old linen which have become soft from wear. Have two of these, preferably slightly warm and thoroughly dry. Never use damp towels. Have handy also a glass or bowl of boracic acid solution for the eyes and mouth, with sterilized absorbent cotton or tiny scraps of sterile and soft old linen.

In giving the first bath, it will be well first gently to wipe off with a soft cloth the olive oil previously applied, and with it any of the "vernix caseosa" which will have been softened by the oil. In giving this first bath, also it will be well to keep the little body fairly well covered, and to wash it a part at a time, drying each part before proceeding to the next. This plan may be continued for the first few days or until the umbilical cord has disappeared and the navel is entirely healed, after which it will be best to use a small baby's bath-tub. If the navel is comfortably and well dressed, it will be just as well not to disturb it in giving the bath these first few days. (See *Care of the Navel.*)

In the case of a feeble infant, or a premature infant, it will be better for several days simply to apply olive oil and wipe it off gently, and to avoid the use of soap and water entirely. This plan might be continued in such a case until the growth and gain in weight have indicated an increase of vitality.

After the first week it is well to use a baby's bath-tub, placed on a table, or high enough to avoid much stooping. Attention should be given to the proper method of holding the baby, for its comfort and enjoyment of the bath will depend much upon this factor. Do not leave the head unsupported and hanging down, as the inexperienced and awkward person would be likely to do, but support the head with the wrist while the hand is extended under the little back, the other hand taking hold of the legs and hips. Placed in the water, the free hand can be used to wash the little body. It is not advisable to use much soap upon the tender skin of the baby in most cases, and it should be applied quickly and rinsed off very thoroughly in the water. The less time consumed in the bath the better. Taken out, the child should be enveloped in one towel which will take up most of the water, and the second towel may then be wrapped around, rubbing the hands over

the towel. Upon taking this off it is a splendid plan to give the entire little body a gentle but thorough rubbing, and particularly the back, which will prove very invigorating and strengthening.

After the bath and rub, the eyes and mouth should be thoroughly washed with the boracic acid, using different scraps of cloth or dabs of absorbent cotton for each eye, after which the genitals should be similarly washed with boracic acid.

The temperature of the bath water, after the first week, may gradually be reduced to ninety degrees, and later to eighty, and the temperature of the room thereafter may be as low as seventy-five degrees. It will often be found advantageous to use the large regular bath-tub, if there is plenty of water, for it is easy to fill and drain. As the child grows older the great amount of water will make the bath a delight to kick and splash in.

Powdering after the bath is a common practice but not to be commended, though if it seems desirable for the sake of dryness, fine pure cornstarch is to be preferred to the scented commercial talcum powders. Powder, however, tends to clog the pores and should be avoided. If the parts about the groin and buttocks become reddened and inflammed, olive oil should be applied, which will protect the skin against wetting.

"Hardening" by means of bathing may be taken up gradually after the first month, or as soon as the baby shows a material improvement in weight and general growth. The best plan is to give a regular warm bath first, and then, immediately upon taking the child from the water, quickly pour over additional water a little cooler than that of the bath. Very gradually the second water may be made a little bit colder, a degree at a time, until it is down to seventy or even to 65° F., but not colder. While a baby is losing weight, or fails to gain, no such hardening process is to be attempted, or where the baby seems of feeble constitution or limited resistance it may be unwise. In other cases, however, it will invigorate and improve the circulation, and will develop the power of resistance against cold. It should always be enjoyed, as a pleasure, rather than feared as a punishment, for when the child dreads the cold water it should not be used. If he recuperates from it properly, he will delight in it.

The time for the bath may be determined by other conditions, though it should always be with an empty stomach. A good time to select is after the nap which follows the morning breakfast, which may bring the bath about nine or ten o'clock. By the time the baby is all dressed

after the bath and ready for the long sleep which should follow it, he will probably be ready also for his second feeding of the day.

Older children will not need the warm bath every day. From the age of two years the warm bath may be given every other day, and later on may be reduced in frequency to twice a week, which is the most satisfactory plan for adults. The cold baths, however, should be given daily throughout childhood, and it will not be many years before the delights of open-air bathing and swimming in river, lake or sea will be a possibility. Remember that these cold baths for the child should be given in a comfortably warm room, and preferably after some romping exercise, when the body itself is thoroughly warm, though not overheated. Enjoyment of the bath is absolutely essential and the water should not be too cold to permit this. And even though the child delights in it, he should not be allowed to remain in the water too long. The shorter the bath, the more certain is perfect recuperation and a vigorous reaction. A short immersion in water a few degrees colder will bring about a better reaction than a prolonged bath in moderately cool water. These matters, however, depend upon the vitality and resistance of each individual child. If he dreads the cold water, a careful study of the general discussion of cold bathing will probably enable you to understand the difficulty, and to so modify or arrange the bath that it may be taken with both pleasure and benefit. A vigorous rubbing after the cold bath will always be advantageous.

Air-baths and sun-baths are of great value both in babyhood and childhood. After the first week or two the child should gradually be made accustomed to exposure to the air, though in the beginning the room should be warm, perhaps eighty degrees, and the time of the air-bath limited. Remember that it is very necessary that the child maintain such warmth and circulation that its feet and hands will be comfortably warm. A little rubbing will help in this, though later his own kicks and bodily movements will be sufficient for this purpose. Soon the child will prefer to spend nearly all of his time unclothed in an atmosphere of ordinary temperature. It will greatly improve the circulation, stimulate the excretory function of the skin through the greater activity of the pores, strengthen and tone up the nerves, and toughen the little body generally. It will go far in the making of a happy and healthy baby.

Exposure in winter weather should not be attempted, however, and on taking the little one outdoors at such a time, he should be

thoroughly bundled up and kept warm. Air baths are healthful, but the baby should not be allowed to become chilled in too cold air.

The sun-baths should be given with discretion, and the little body inured to them gradually. The vertical rays of the sun at noon on a summer day would be too harsh. In summer the rays of the sun in the early morning or late afternoon will be better. And the sun-baths, like the cold water baths, should never be carried beyond the point where the child enjoys them.

Bowels.—Regular activity of the bowels is of great importance in infancy, and the character of the stools indicates to a certain extent the condition of the alimentary canal and general health of the child.

There is usually a movement of the bowels immediately after birth, or within a few hours thereafter, and there should be normally two or three each day for the first week thereafter. During the first two or three days a dark greenish, sticky substance is passed, known as *meconium,* but after elimination is established the passage is a natural yellow and of a soft, smooth consistency. After the first week a healthy child may have either one or two movements each day, or perhaps even more.

Constipation should never be neglected, and for immediate relief a small injection of pure water, at 98° to 100° F., is the best treatment. This is best given by a fountain syringe, not placed too high. A bulb syringe is commonly recommended, but the too great pressure sometimes applied may be injurious. Water should never be *forced* into the rectum, even in adult life. The soap suppositories recommended by our grandmothers were effective, but irritating and detrimental, removing natural oils. Gluten suppositories are better, but should not be depended upon as a habit. A very satisfactory suppository is a small paper cone, not too stiff, and well oiled. Rotary massage of the abdomen is very valuable; this should be applied in the direction of the movement of the hands of a clock.

In chronic cases the diet should be depended upon. When breast-fed, the diet of the mother should be improved. If bottle-fed, a little additional cream will usually solve the difficulty in the early months, while the use of a little strained orange juice midway between feedings after four months will often remedy constipation of that period. In giving modified milk, dilution with oatmeal water instead of barley water or plain boiled water will maintain satisfactory activity.

Diarrhea, if present in a severe form, indicates a diseased condition. One or two enemas will help Nature's attempt to cleanse the alimen-

tary canal of the irritating and unwholesome matter, and a fast of twelve to twenty-four hours, perhaps even a little longer, will be of great value, meanwhile giving water, distilled or previously boiled, freely. No drug treatment should be given to stop the diarrhea, which is a curative process as well as a symptom. If there is only a tendency toward diarrhea in a bottle-fed baby, slightly reducing the amount of cream will usually set matters right.

Training of the child in regularity of habits is important, as well as a great convenience to the practical mother, since in this way the unpleasant task of washing soiled diapers can be practically avoided. This training can be advantageously begun at the age of five or six months, by having the child's bowels move at the same time each day. The child can be held upon a very small chamber placed between the knees of the mother or nurse, with his back supported against her chest, or, later, may be placed upon a chamber chair such as is to be found in any large furniture or department store. In the latter case the front cross-board should be fastened securely, and perhaps a pillow placed at the back in the early months. At first it will be necessary to induce the movement by means of a small cone of oiled paper, a very small rectal injection, or even a glycerin suppository, the latter being suggested only because it is less objectionable than soap. After a time, when regularity is established, it will merely be necessary to place the child in the customary position. The attempt should be made following a full feeding each day at the same time.

Carrying the Baby.—Care should be observed in holding and carrying little ones to insure a position which will be comfortable and free from danger and injury to them.

An infant, during its first few months, derives very little satisfaction (but what might be secured otherwise) from cuddling and loving contact, but its sensitive, pliant responsiveness to any and all sensations soon renders them necessary to its comfort, and bad habits are thus formed. It is merely an embryo at this stage and is governed by whatever influences are brought to bear upon it. If it is cuddled, it inclines to that form of satisfaction; if it's simply to lie quietly in its snug little crib, and just grow, then that is the line of least resistance for him—that is the direction his fancies will follow.

Let the child learn, and learn early, to amuse itself, to solve his own problems, to make little of the knocks and bumps which must come to his little body as well as to his heart and brain.

Clothing.—The new-born infant, having a limited capacity for generating heat, and a larger surface in comparison with the weight of the body than when it gets older and larger, requires sufficient clothing to keep it thoroughly warm during the early weeks of its life. After that it should be gradually accustomed to the air.

The clothing of the infant should be loose and light and as simple as possible. Loosely woven fabrics which provide room for an inner layer of air are warmer than those of the same weight and substance tightly woven. Freedom of movement is important, and all binding or pressure upon any part cannot help but interfere with the circulation and otherwise produce bad results. All clothes should be changed, from the skin out each day. *They should not be starched.*

The necessary garments for the baby immediately after birth are as follows: Woolen abdominal bandages, shirts, diapers, pinning blankets and slips.

The abdominal bandage should be a strip of flannel perhaps five inches wide, and running twenty-seven inches or whatever the width of the goods may be. This will probably go around the body about twice, and should *not* be hemmed, for this will interfere with its fit and comfort. Notches like the teeth of a saw may be cut to prevent raveling, with the insertion of a moderate gore in the middle of one side to make it conform better to the shape of the body, this gore placed downward in putting on the band. It should preferably be sewed or basted on, though tiny safety-pins may be used placed horizontally. It should only be snug, great care being taken to avoid constriction. If it seems to get tighter later in the day, it should be loosened. A band too tight may lead to rupture at the navel. Four or five of these flannel bands will be sufficient.

A knitted band can be used after the first couple of weeks, or after the navel is healed and no longer requires that a dressing be held in place. The preferred style is one with shoulder straps to hold it in place above, and with a little tab or projection below which may be pinned to the diaper when the latter is fastened, and with the same safety pin. This band, which is half band and half shirt, should be warm, of soft wool or mixed wool and silk.

Shirts should be *loose,* and may be either of soft knitted wool or silk and wool in winter, or in summer of light silk and wool, silk and cotton, or cotton. In summer there are cool days as well as hot days, and it is well to have shirts to correspond to the changes in the weather.

Woolen garments may be washed satisfactorily if only white soap is used in a light suds of medium warm water, and then rinsed in water of the same temperature. If it is feared that they will shrink too much, they should be dried stretched over an improvised frame. Special frames are manufactured for this purpose, but any clean boards or household objects of appropriate size will answer the purpose just as well, with no expense. Shirts should be loose and free around the armpits especially.

Diapers should be provided in a sufficient number to be able to use them clean and thoroughly dry at all times. Linen or cotton bird's eye, Daisy cloth, plain cotton flannel or any other suitable cloth may be used. The wet diapers should never be dried and used a second time without washing, for the salty deposits of the urine will prove irritating. The wet diapers should be scalded in hot water and very thoroughly rinsed in several waters. They should be dried in the sunshine, if possible. Soiled diapers should be well washed and boiled. They may be rinsed off in a toilet immediately, and afterward washed thoroughly. Soap powders, washing soda, ammonia and the like should be avoided, for they will prove extremely irritating to a delicate skin unless rinsed in many waters. It is a labor-saving plan to place small sections of absorbent cotton inside the diapers when they are put on, or perhaps pieces of absorbent gauze, so that these small squares will hold all or most of the bowel movements, then to be burned. If there is irritation of the skin, the parts should be sponged off with clean water at each change, paying special attention to cleanliness of the genitals. If sore, olive oil will soothe and serve as a protection against wetting. (See also suggestion for training of infants, under *Bowels.*)

Petticoats and dresses may with great advantage be replaced by the pinning blankets and slips mentioned, during the first three or four months. Simplicity and convenience in clothing is demanded at this time, rather than fussiness, and the infant should be disturbed as little as possible by dressing.

The pinning blanket may be made out of a light weight flannel, and cut in such a way that the band part comes around the body and laps over, conforming to the size and growth. It should be put on so that the opening lies in front, which is very convenient for changing the diaper. It should be made longer than the other clothes so that the bottom may be folded over and pinned, thus enclosing the legs and keeping them warm. The slips should be made without

trimming and as simply as possible. It is less disturbing if they are put on over the feet.

At three or four months the pinning blankets and slips may be discarded entirely in favor of the regular petticoats and dresses. A length of twenty-seven inches is recommended, for excess in length is a bother and a waste. Economy, however, sometimes suggests a greater length for the petticoats, so that later, when the child is put in short clothes, each one may be cut in two, making two petticoats. Flannel petticoats for winter are best cut all in one piece, the flannel running up to the shoulders, and buttoned down the back, this style being much warmer than one made with a band.

From the time that short clothes are adopted, and this should be soon for the sake of freedom of movement, knitted "booties" may be worn until the child commences to stand or walk. It is better not to put on shoes before this time, for the little toes should have the utmost freedom. Socks may be worn from the beginning, if the baby is born in the winter, and should be white. They should be pulled up to the groin and pinned to the diaper. Shoes, when adopted, should be broad in the toes, even what seems unnecessarily broad. The straight soles are most unsatisfactory. They should be made in rights and lefts, the same as for older children.

Waterproof diaper coverings are of great advantage. Rubber sheeting should not be used for this purpose, but there are other prepared sheetings of unobjectionable texture on the market. These waterproof protectors may be purchased ready-made, but it is often satisfactory to make them at home.

A child should always be changed as soon as it is known that it is wet. It is better to have one diaper wet, and to change it, than to find diaper, petticoat, dress, blanket and mattress all in a soaking condition, through the lack of such a protector, and to be compelled to wash all of these or have them in an unwholesome condition. Or, if the child is playing on the floor, it is much less likely to be chilled with a waterproof covering on than if all of its clothes are wet through and exposed to the currents of the air. The effect of the wet diaper in irritating the skin is just the same without the covering as with it. To insure against prevention of a proper circulation of air it must not fit tight and it is essential that both sides be kept well open. On the whole the practical mother will not be willing to do without this convenience, once she has used it.

Nightgowns should be as simple as possible and fairly long. In the

winter they may have a shirr-string around the bottom to enclose the feet completely for warmth, and if the child throws its arms out on bitterly cold nights, small shirr-strings may be placed in the cuffs of long sleeves to close them also. In such a case, furthermore, it will be well to put on a warm knitted jacket to protect the shoulders, chest and arms. If it is difficult to keep the child covered, the coverings should be tied.

Creeping and playing on the floor, in the later months of infancy, demand clothing of a type very different from the pretty white dresses which mothers usually love. It is right that the baby should creep and roll on the floor, and the clothing should be accommodated to his needs. Rompers and creeping aprons, or at least colored dresses should be adopted for everyday wear. In cold weather a dark colored outing flannel may be used for the purpose. As the child grows older and plays outdoors in the sand, overalls may be used as well as rompers, for both boys and girls. They should be dressed in such a way that their freedom of action and play will not be restricted.

Constipation.—See *Bowels.*

Development of Infants.—Although all children do not develop at the same rate, the following details of the appearance and conduct of infants at various stages of development are considered by standard medical works as a safe standard of the development of children. No concern should be felt through failure of a child to exhibit any of the characteristics here described at a certain time unless several months elapse without any sign of the little one developing the faculties normally possessed by a child of its age. Should such a condition occur, general health-building measures should be at once inaugurated, and proper authorities consulted as to the cause of the retarded development of the youngster.

First Month.—Sensitive to light as early as first and second days. Pleasure in artificial light and in bright objects on eleventh day. Hears on fourth day. Discriminates sounds last two weeks of month. Starts at gentle touches second and third days. Sensibility to taste about end of first week. Strong-smelling substances produce mimetic movements at birth. Pleasure first days in nursing, in bath, in sight of objects. Discomfort first days from cold, wet, hunger, tight clothing. Vowel-sounds in first month. Memory first active as to taste and smell; then as to touch, sight, hearing. Incoordinate movements of eyes. Sleeps two hours at a time, and twenty hours in twenty-four.

Second Month.—Strabismus occasionally until end of month. Rec-

ognizes human voices; turns head toward sounds. Pleased with music and with human face. Sleeps three, sometimes five or six hours. Laughs from tickling at eighth week. Clasps with its four fingers at eighth week. First consonants from forty-third to fifty-first day (am-ma, ta-hu, go, ara).

Third Month.—Can utter a cry of joy at sight of mother and father; eyelids not completely raised when child looks up. Accommodates at ninth week. Notes sound of watch at ninth week; listens with attention.

Fourth Month.—Eye-movements perfect. Objects seized are moved toward the eyes. Grasps at objects too distant. Joy at seeing self in mirror. Contraposition of thumb in grasping at fourteenth week. Head held up permanently. Sits up with back supported at fourteenth week. Beginning to imitate.

Fifth Month.—Discriminates strangers. Looks inquiringly, pleasure in crumpling and tearing newspapers, pulling hair, ringing a bell. Sleeps ten to eleven hours, without food. Desire shown by stretching out arms. Seizes and carries objects to mouth. Consonants l and k.

Sixth Month.—Raises self to sitting posture. Laughs, and raises and drops arms when pleasure is great. "Crows" with pleasure.

Seventh Month.—Astonishment shown by open mouth and eyes. Recognizes nurse after four weeks' absence. Sighs. Imitates movements of head, of pursing lips. Averts head as a sign of refusal. Places himself upright on lap.

Eighth Month.—Astonishment at sounds and sights: at imitations of cries of animals.

Ninth Month.—Stands on own feet, with support. More interest shown in things in general. Strikes hands together with joy. Shuts eyes and turns head away when something disagreeable is to be endured. Fear of dog. Turns over when laid face downward. Turns head to light when asked where it is. Questions understood before child can speak. Voice more modulated.

Tenth Month.—Sits up without support in bath and carriage. First attempts at walking at forty-first week. Beckoning imitated. Misses parents in absence. Cannot repeat a syllable but may attempt imitation (ma, pappa, tatta, appapa, baba, tata, pa, rrrr, rrra).

Eleventh Month.—Screaming quieted by "sh." Sitting becomes habit. Stands without support. Stamps. Syllable correctly repeated. Whispering begins. Consonants b, p, t, d, m, n, r, l, g, k, vowel a most used, u and o rare, i very rare.

Twelfth Month.—Pushes chair. Cannot raise self or walk without help. Obeys command. Gives the hand.

Thirteenth Month.—Creeps. Shakes head in denial. Says papa and mama. Understands some words spoken.

Fourteenth Month.—Cannot walk without support. Raises himself by chair. Imitates coughing and swinging of arms.

Fifteenth Month.—Walks without support. Laughs, smiles, gives a kiss on request. Repeats syllables. Understands a few words.

Sixteenth Month.—Runs alone. Falls rarely.

Seventeenth, Eighteenth and Nineteenth Months.—Sleeps ten hours at a time. Associates words with objects and movements. Blows horn, strikes with hand or foot, waters flowers, puts sticks of wood in stove, washes hands, combs and brushes hair, and makes other imitative movements.

Twentieth to Twenty-fourth Months—Marks with pencils on paper, whispers in reading newspapers. Very few expressions are recognizable. Executes orders with surprising accuracy. Tries to sing and beat time and dance.

Twenty-fifth to Thirtieth Month.—Distinguishes colors correctly. Sentences of several words. Begins to climb and jump and to ask questions.

Thirtieth to Fortieth Month.—Goes upstairs without help. Sentences correctly applied. Clauses formed. Words distinctly spoken, but influence of dialect appears. Questioning repeated to weariness. Approximates manner of speech to that of family more and more.

Diarrhea.—See *Bowels.*

Diet of Children.—See *Older Children,* under *Feeding.*

Diseases and Disorders of Infancy.—A vigorous normal infant, properly cared for, will usually escape sickness of any kind, being apparently immune even to some disorders which are regarded as contagious, because of its powers of resistance. Signs of illness, however, should be promptly attended to. If the mother does not know the nature of the trouble, then at least she can be sure that either there is some digestive disturbance or that the young organism is attempting to eliminate foreign matter or poisons. In either case, feeding should be stopped immediately, plenty of warm water being given instead, previously boiled and given warm in nursing bottles. If fever is present, it may be given moderately cool, but not cold. The bowels should be looked after, and an enema will be of great value, especially if there is constipation. The feet should be kept warm, and usually

warm abdominal packs will be of advantage. Plenty of fresh air is of vital importance.

The general suggestions given in Volume II, Part 11, under *Children, Diseases* of, should be carefully read. Most important childhood diseases, such as measles, scarlet fever, whooping cough, rickets, etc., are taken up separately and in detail in Volume IV. Constipation and diarrhea are referred to under the head of *Bowels,* in this Part. (See also *Temperature,* this Part.)

Colic is not an uncommon complaint among young infants, especially when improperly fed or exposed in such a way that abdomen and lower extremities become chilled. Placing the feet in warm water (100° to 108° F.) will usually stop it, but in a stubborn case a small hot water bag at the stomach, with another at the feet, or perhaps a warm enema, from a fountain or bulb syringe, at 105 to 110 degrees, may be necessary.

For *Convulsions,* see *Eclampsia.*

Ears, Care of.—In the care of the ears it is unwise to insert hairpins, toothpicks, matches or other hard objects, even though covered with cloth or cotton. It is well always to dry the ears thoroughly after the bath, but for this purpose one should use absorbent cotton, a wad of which may be twisted into the shape of a small finger or cone, which will be sufficiently stiff for insertion and yet soft enough to avoid doing any injury. In case of earache or running of the ears, put in a few drops of warm olive oil, plug with cotton, and then apply warmth with a hot water bag or other warm object.

Exercise.—See *Training and Education of Children.*

Eyes, Care of.—Of special importance is the care of the eyes in early infancy, and they should be washed every day with boric-acid solution, one teaspoonful to a glass of boiled water, tepid when used. The washing of the eyes the first few days should be very thorough, for infection at birth may lead to loss of sight if neglected.

A sponge should never be used, but rather pieces of absorbent cotton, each one thrown away after using, and never using the same one on both eyes. The lids should be held apart gently with the fingers, and by squeezing the cotton above the eye, a tiny stream should be allowed to run over the open eye, from the inside toward the outside corner, but not across the bridge of the nose and into the other eye. In other words, if one eye is infected, the infection should not be carried to the other. This should be repeated several times at first, or whenever there seems to be any pus or inflammation.

The eyes are very delicate and sensitive at first, and therefore should not be exposed to any glaring light for some time. Exposure to the direct rays of the sun should be avoided, even when shut, for the lids are almost transparent, and artificial lights in the house would better be shaded, especially electric and gas lights.

Feeding and Nursing.—Mother's milk is the best food for the human infant during the first year. Failing in the supply of mother's milk, substitutes may be used, but they are never so perfect or so much to be depended upon as the milk of a normal and healthy mother.

The Milk Diet for Nursing Mothers.—Many mothers have found that the exclusive milk diet produces an excellent means of stimulating the secretion of milk for nursing infants. Care should be taken in undertaking the use of this diet to insure that it agrees with the mother perfectly. Even when the use of the exclusive milk diet is impracticable, a fair amount of milk can be consumed daily to advantage.

The nursing of a baby would seem to be the very simplest of all things, and yet there are common mistakes which are so detrimental to the welfare of the child that it is well to emphasize a few important rules in regard to infant feeding. Two of the most important mistakes are those of overfeeding and irregularity. Most babies are very much overfed, and much prevalent illness among infants is due to this fact. Irregularity also is a cause of digestive disturbance and general functional derangement. It has generally been the habit of uninformed mothers to nurse their babies at any and every time of day and night, at the least signs of discomfort upon the part of the little ones, thereby keeping them in such a state of uneasiness that they are likely to cry both day and night. Every time the baby opens his mouth to cry, the old-fashioned mother fills it and quiets it with the generous supply from the maternal glands, the very expression of her love thus acting against the welfare of her dearest one.

Regularity in feeding is a very important matter in infancy, allowing each meal to be digested before partaking of another, and establishing the habit of being hungry and having the hunger satisfied at the same hours each day. It is a common thing for mothers to fear that baby is not getting enough nourishment, but in many more cases they should fear the excess of feeding that is inclined to bring on disease. All books on the care of children have formulas or tables of the number of feedings for babies of different ages, but if anything

one should discount them somewhat to get the very best results. That is to say, one or two less feedings per day, at longer intervals, than is suggested in the table for a particular age, will sometimes prove more satisfactory. But in all cases the parent should map out a special time table suited to her own baby, and adhere to this strictly in order that the regularity may not be interfered with. We sometimes read pretty expressions of sentiment regarding the "old-fashioned mother" who fed her baby whenever she thought of it or felt like it, but this sentiment takes no stock of the deplorably high infant mortality rate of the past. Not only is regularity favorable to the digestion of the infant, but also to the secretion of milk in normal and satisfactory quantities. With regular feeding, also, the child is trained not to cry for the breast at other times.

The practice of night feeding is one that may with great advantage be done away with in most instances. It may be desirable to give one night feeding the first few weeks, but after the first month, or as soon as possible, the child should be trained to pass the entire night without nursing, have its last meal perhaps ten o'clock in the evening, and that meal a satisfying one. The child will soon learn not to cry for the breast at night, and the fast of several hours during the night, say, from 10 P.M. until 6 A.M., will be of great value in resting and strengthening the young digestive apparatus. The baby that goes without the night feeding is much less likely to develop colic or any other disorder. Furthermore, if the mother can sleep through the entire night without having her rest broken, the gain in her vitality will be such as to provide a better quality of milk during her waking hours, and thus further promote the welfare of the child.

The stomach of the new-born infant is small, being perpendicular and looking somewhat like a part of the intestines which has been dilated. It has a capacity of only about two or three tablespoonfuls at first, so that during the first week it is well to give the feedings at intervals of two hours, and giving nine or ten feedings per day. With the second week the intervals should be two and a half hours, with seven or eight feedings per day, and after three months intervals of three hours should be observed with not more than six feedings per day. At seven or eight months intervals of three and a half hours should be allowed, with perhaps five daily feedings.

There will naturally be variations in the time and number of feedings in different cases, according to individual requirements and peculiarities, so that the following time-table must not be regarded as

an ironclad rule to be followed. It is merely offered as a suggestion, for babies of normal weight and development. Those that are backward in growth or below normal weight should be fed *according to weight* rather than according to age, or in other words, according to the age of a normal child of the same weight.

NURSING TIME-TABLE

First Week		Second Week to Three Months		Three Months to Seven Months		Eight Months	
A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.
3:00 (Night)		7:00	2:30	7:00	1:00	7:00	2:00
6:30	1:00	9:30	10:00	10:00	10:00	10:30	
(Bath	3:00	(Bath	5:00	(Bath	4:00	(Bath	5:30
at 8:30)	5:00	at 9:00)	7:30	at 9:30)	7:00	at 10:00)	9:00
9:00	7:00	12:00					
11:00	9:00						
	11:00						

Remember that it is the baby with the keen appetite, and the ability to assimilate every drop of food that it takes, that will thrive the best. It is especially important that the baby should be hungry for the last feeding in the evening so that it will be satisfied for the night. And so that it will sleep soundly through the night, it should not be encouraged to sleep all the early evening. Plenty of sleep is necessary, but there is plenty of time for this through the day and during the long stretch of the night after the last feed. If it can be kept awake during the evening, and perhaps given some of its exercise at that time, the normal baby will be ready at the proper time to sleep and let others sleep.

The first feeding should be given some time during the first day, perhaps after its first sleep or after the first bath. This is not really a feeding, for the secretion of the breasts in the beginning is a laxative fluid called *colostrum,* which is valuable for purging and cleansing the alimentary canal of the infant. The supply of real milk comes the third day. A little warm distilled or boiled water may be given if desired the first couple of days, but no other fluids, and certainly no "teas" or concoctions of any kind. It may be necessary to use some patience in the beginning to train the child to take the breast, and it should always be comfortably supported when nursing. Whether

lying down or sitting up the mother should hold the child up to the nipple in a semi-upright position.

It is also best to give each breast alternately, rather than some of each breast at each nursing, for the reason that the supply should be well trained in order to maintain the activity of the glands. Furthermore, the proportion of fat is greater toward the end of each feeding, and if only a part of the milk from each breast is used, the child will not secure a properly balanced proportion of nutritious elements.

The length of time consumed in each feeding may be from ten to twenty minutes, but never longer than the latter period. If the child desires to nurse longer than this, and cries or frets upon leaving the breast, then there is reason to believe that the supply of milk is insufficient. If attention to the health of the mother, and to her diet, does not soon remedy this condition, it will be wise to place the child either partly or entirely upon the bottle. In some cases a combination of nursing and bottle feeding will serve satisfactorily.

The question as to whether or not the child should be awakened for the sake of feeding, if it is asleep at the scheduled hour, is one that invariably arises. One is naturally disinclined to arouse a baby from its sleep, but if punctual adherence to the regular hours of feeding and bathing is observed, the little one can be trained to be awake at the right time and to sleep in the intervening periods. It will not be necessary to wake it up more than a few times, as a rule, and it is worth the trouble to establish the habit.

The condition of the mother is a most important factor in determining both the quantity and the character of the milk. She should do everything possible to maintain the highest degree of vitality and health, getting as much outdoor air as possible, and observing a wholesome and nutritious diet. The quantity of milk can be influenced somewhat by regulating the amount of liquid food consumed, increasing or decreasing as desired. The fat in the milk is readily influenced by the diet of the mother. To increase the albumin one should take a great deal of exercise, particularly out-of-doors. No other special suggestions are necessary here, beyond emphasizing the value of health and pure blood. The subject of diet as presented in a previous volume of this work should be carefully studied, remembering that whatever is most conducive to the vitality and welfare of the mother will best provide for a satisfactory secretion of milk. Those things which have a particularly strong odor or taste should be avoided, including condiments, mustard, horseradish and the like, while everything in the

nature of alcoholic beverages, tonics containing alcohol, or drugs of any kind whatever should be religiously eschewed. All these poisons may be taken by the child through its mother's milk, and they are particularly injurious to the tender young tissues. Anger, grief and excitement impair the quality of the milk, and the baby should not be nursed when the mother is mentally upset.

A wet-nurse is to be preferred to artificial feeding when the mother's milk fails, providing a satisfactory wet-nurse can be secured. She should be thoroughly healthy and preferably not over thirty years of age, and it is important that the period of lactation in her case should conform more or less to the age of the child. A wet-nurse of several months' lactation would not suit perfectly the requirements of a new-born baby. She should have no chronic or constitutional disease, and should be of a steady, quiet temperament. An excitable or nervous wet-nurse is undesirable. On the whole the same general requirements of health which apply in the case of the mother will also apply to the wet-nurse. She must be scrupulously clean.

The nipples must be well cared for, for the sake of both the mother and the child. They should be thoroughly cleansed both before and after nursing, boracic acid being a good cleansing agent. If there is a scaly coating, olive oil should be applied, to be washed off before the next nursing. Nursing by a very strong baby sometimes causes great tenderness, and this should be counteracted by an attempt at hardening the nipples.

It is sometimes well in the case of the first baby, to commence treatment for this purpose before the birth of the child. An equal mixture of water and alcohol is often recommended for this purpose, while glycerin is considered to be both healing and hardening. In using these preparations special care should be used in washing the nipples before nursing. When there are fissures or cracks which make nursing very painful, a nipple shield may be used until they heal. The baby may object, but if he is hungry as he should be he will take the artificial nipple. The nipple shield should be thoroughly cleaned before and after nursing. Where the nipple is depressed or flat, attention should be given to it each day during the period of pregnancy, pulling it out with the fingers to its proper condition. If still it does not stand out in such a way that the infant can take hold of it, then just before the nursing it may be pulled out by the suction of a warm bottle, the neck of which is placed over it. Any clean bottle will do, the neck of which fits over the nipple. It may be heated moderately by

dipping in hot water, the neck placed snugly over the nipple, and as the bottle cools the partial vacuum thus created will draw the nipple out and into the neck. Removing the bottle, the baby will have no further difficulty in taking hold and drawing the nipple out still more perfectly. Treatment of this kind will usually remedy the defect in a short time.

The weaning of the baby will depend entirely upon the mother and the continuance of a sufficient milk supply. In many cases nursing may be continued for the entire first year. It very often happens that the supply of mother's milk commences to fail when the child is nine months old, while its needs are constantly increasing, and sometimes the supply fails much earlier than this.

Weaning should take place at any time when it is found that the child is not satisfied with the breast or when it ceases to gain as well as before. There is no doubt, also, that nursing a child under these conditions becomes a drain upon the mother. As a rule the baby will be ready for weaning before reaching ten or twelve months, unless the condition of the mother makes it necessary earlier. Another guiding rule is that the child may be weaned when it has from eight to twelve teeth, though when dentition is much delayed this rule cannot be followed. Restlessness upon the part of the child, peevishness, irregularity of the bowels, inability to sleep, lack of energy in creeping or playing, loss of color, or of weight, are all signs indicating the need for a change. Likewise, pregnancy, inflamed breasts, nervousness or illness upon the part of the mother, will all demand immediate weaning.

Under ordinary conditions it is perhaps best to wean the child gradually, the first day giving one artificial feeding, and then gradually increasing the amount or number of bottle feedings until the breast is discontinued entirely. An indisposition to take the strange nipple will be readily overcome by waiting for the impulse of sufficient hunger. The food given, when weaning, should correspond to that suggested in the following pages for an infant of the same age brought up on the bottle. At ten or twelve months nearly every child will be able to take pure cow's milk of average richness, possibly modified to suit the individual case.

Bottle Feeding.—Although human milk and cow's milk contain the same chemical and nutritive properties, yet the proportions are different, and the latter is therefore not nearly so satisfactory for the human infant as the former. And yet, when the former fails, very satisfactory

results can invariably be secured with the use of cow's milk by modifying it somewhat so as to make it resemble the human milk as much as possible. It is quite important, however, especially in the case of a weak baby, that it should have mother's milk for the first three months at least, and in the event of the death or illness of the mother, a wet-nurse would be recommended for at least a time. But if the baby is strong and vital, it will thrive on modified cow's milk if it is properly taken care of and is not overfed.

In a general way, the comments that have been made on overfeeding and irregularity in the case of nursing will apply to bottle-fed babies as well. Nearly all are stuffed too much. The rules in regard to avoiding night-feedings, regularity during the day, the number of feedings and other matters discussed in connection with the use of mother's milk will apply here.

There are a number of prepared artificial foods which are commonly used for bottle feeding, chiefly based upon a combination of malted grains and sugar with cow's milk, and in some cases they seem to prove very satisfactory. It is generally agreed among students and authorities, however, that fresh cow's milk, modified if necessary, is far more satisfactory in most cases. Sometimes these foods have the result of producing fat babies, but this is not always an indication of vitality or of a healthy, well-nourished condition. But there are some cases in which these preparations may be found more suitable.

The child feeding from a bottle can manage the bottle best, as a rule, when lying upon its side.

If driven to resort to them, only experiment will determine which one the baby will take and find itself in agreement with.

Goat's milk and mare's milk might be used for infant feeding but they cannot be secured conveniently and in satisfactory quantities, like cow's milk. The latter contains a higher percentage of solids than human milk, and particularly a higher percentage of proteids, and it is on this account that it is desirable to reduce it with water so as to make it possible for the delicate stomach of the new-born baby to digest it. Mother's milk, again, is considerably sweeter than cow's milk, and it is for this reason that a little sweetening is added to the modified cow's milk in order to make it more nearly equivalent to the human milk. Milk sugar is always used for this purpose. Cane sugar should not be used since it is likely to ferment and cause trouble. The following table shows the proportion of ingredients in human milk and cow's milk, in every thousand parts:

	Fat	Proteids	Sugar	Mineral Salts
Human Milk ...	38	17	60	2
Cow's Milk .	31	36	45	7

Other analyses may differ slightly from this proportion, but this will suffice for a general comparison. The proportion of proteids, it will be noted, is in cow's milk a little more than double that in human milk. Now, while the digestive system of the baby will digest the fat very readily, the proteid is likely to give it trouble. It is particularly for this reason that the cow's milk should be diluted with water in the early months, and in order to bring up the percentage of fat to something more nearly like that of human milk one may use, instead of the whole cow's milk, a larger proportion of the cream. It is usually found that the baby can digest diluted cream from the very first day, and if the child is feeble and cannot be nursed, the food should consist in the beginning of a large proportion of cream, well diluted, with milk sugar and a little lime-water. As it gradually grows older and digestive powers grow stronger, the proportion of milk should be increased. The addition of lime-water is intended to counteract the acid character of the cow's milk, for it is sometimes acid, and the infant requires an alkaline food. Human milk is alkaline.

Cream, or milk rich in cream, may be obtained by skimming milk contained in a flat basin, or by dipping with a special cream dipper

from the top of a regular milk bottle. For practical purposes, however, it is just as well to pour out of the milk bottle in which the cream has settled at the top. The very first poured off will be largely cream, and as more is poured a greater percentage of milk is secured. We would suggest for the practical mother, therefore, that a very satisfactory plan is to begin by pouring off a very little from the top of the bottle, and later gradually pour off a large amount as the needs of the child increase and it is ready for a larger proportion of milk in its foods. Or a good practical plan would be, for the first three or four months, to pour off the upper one-third of a bottle of milk of good average quality. After three months one may gradually pour out a larger amount, thereby increasing the proportion of milk and of proteids in the food.

Some variations may be needed in different cases, and with some children it may be advisable to use less cream, though in such cases it will be necessary to have the milk diluted with the same amount of water. In a general way, however, the following table may be suggested, and will be found satisfactory in most cases. The top-milk is that poured from the top of the bottle, as suggested, and fairly rich in cream. In measuring milk sugar, note that one ounce equals five heaping teaspoonfuls. After boiling the water and cooling it, add the milk sugar and lime-water, and finally the milk, bottling in the nursing bottles, thoroughly cleaned, and cork with tight wads of antiseptic cotton. Keep on ice until used, and heat to 98° to 100° F. (not too hot) before giving to the baby. Bottles and nipples should be cleaned by boiling each day in soda water, and carefully rinsed.

TABLE OF BOTTLE FEEDING OF AVERAGE INFANT

Age	Top-Milk	Milk-Sugar	Lime-Water	Boiled Water	Amount of Each Feeding
Up to 1 Month	5 oz.	1 oz.	1 oz.	15 oz.	1½ to 2 oz.
1 to 2 Months	7 oz.	1 oz.	1 oz.	15 oz.	2 to 3 oz.
2 to 3 Months	10 oz.	1 oz.	1 oz.	15 oz.	3 to 4 oz.
3 to 4 Months	15 oz.	1 oz.	1 oz.	15 oz.	4 to 5 oz.
4 to 6 Months	20 oz. (Whole Milk)	1 oz.	1 oz.	15 oz.	5 to 6½ oz.
7 to 10 Months	25 oz.	1 oz.	1 oz.	10 oz.	7 to 8 oz.
10 Months and Upward	32 oz. (1 Qt.)	1 oz.	1 oz.	8 oz.	8 to 10 oz.

In the number of feedings per day, the schedule suggested in the time-table for nursing, on a preceding page, should be followed, always with pains to avoid overfeeding. The increase in the amount of each feeding should be made gradually, and the increase in the strength of the food should be made gradually. For instance, instead of suddenly adding five ounces of milk at the end of a month, it would be better to add an ounce at a time each week, but observing the general progress indicated in the table. If the baby vomits after feeding, through excess of food, although apparently digesting some of it and gaining continuously, simply give a half ounce or an ounce less to each feeding.

In the case of children weaned at six months, whole milk is used, gradually introducing the milk feeding each day, taking about one week to complete weaning. Two or three times a day a bottle of boiled water which has been aerated and sweetened with milk sugar is given. A half or a whole orange is fed from a spoon each day, or it may be slightly diluted and strained and fed from the bottle. If juice of an orange is not given, a teaspoonful of lime-water may be mixed with each bottle of milk. Even with orange juice it may prove advisable to add the lime-water to milk. When the child is not eager for food, water may be given.

When the slightest evidence of illness of any kind appears, boiled sweetened water is given instead of milk. The water may be sweetened with honey instead of sugar of milk. Honey in nearly all cases has a laxative effect.

In cases of babies weaned at ages ranging from one to four months, the schedule found in the previous table may be followed with the exception of the quantity of water used. The water may be lessened, and two or three feedings of water alone given to the little one between feedings of milk during the day. This method enables the infant to settle for itself the amount of water it needs to digest its food. Special care should, of course, be used in feeding whole milk to be sure that the infant can digest it, but it is somewhat safer to give water in between feedings, as the instinct of the child is usually a better judge as to how much liquid it needs to aid the digestion of the nourishment it requires.

Milk should never be fed with a spoon to a child at any age; it should always be given from a bottle. The sucking process forces the saliva in the mouth and thus mixes it with milk, an important part of the digestive process.

Do not be afraid of fasting the baby at times. A fast of one day, during which period the child is given only water sweetened with sugar of milk or honey, is of very great value in remedying ailments of various kinds. In some few instances where the complaint is considered serious, even a two days' abstinence from milk, freely using water sweetened with honey will be of great advantage. Sweetened water given in this manner will fill the infant's little stomach and will satisfy it for a time and the system is thus given a chance to remedy difficulties that may prove serious. Many infantile deaths are due to improper or over-feeding.

Malnutrition, the inability to digest or gain weight from food, is in most cases caused by over-feeding. A one or two day fast followed by the right sort of feeding methods will often bring about an immediate change for the better. This is especially true where aerated boiled water, as described, is given between two to four feedings during the day.

As nearly all infantile ailments are caused by over-feeding about the first thought to keep in mind whenever an ailment of any kind appears, is to clean out the stomach. This can be done very effectively with infants by tickling the throat with the finger and in this way inducing vomiting. By continuing this process the stomach can be thoroughly cleansed and often this means alone will effectively prevent the de-

To cleanse the stomach of a child, vomiting may be induced by tickling the back of the mouth with a finger. In very young children, this should be accomplished with the smallest finger.

velopment of a complaint that, if left neglected, might become very serious.

When a meal does not agree with the child, this plan can be used advantageously. Be sure to remember the very great importance of depending on boiled, aerated water, sweetened with honey for nourishment when you are doubtful of giving the child its ordinary food—milk.

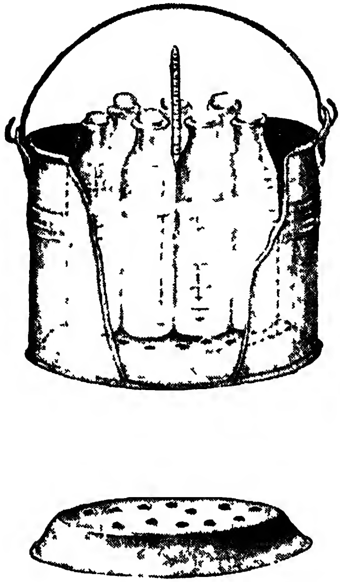
Nipples with only a very small perforation should be used, in order that the food be taken very slowly, allowing from ten to twenty minutes to finish the bottle. When the filled bottle is turned upside down, liquid should only drop from the nipple, but never pour in a fine stream. This is very important. If you perforate the nipple yourself, first stretch it over a cork, then puncture with a fine needle made red hot. It is well to use nipples that can be turned inside out to permit thorough cleaning. They should be sterilized by boiling every day, then kept in a boracic-acid solution while not in use and rinsed in boiled water before using.

The quality of the milk is a matter of great importance. It should be as fresh as possible, and the conditions under which it is prepared should be as nearly perfect as possible. Cleanliness is a vital consideration in determining the character of the milk, and in cities where the supply is of doubtful character it is well to secure certified milk, if it is to be had. Even this may not be all that is desired, but it is safer than the use of ordinary milk. Lime-water prevents souring.

Pasteurizing is recommended as a means of safeguarding against disease germs. As a general rule, good, fresh milk is to be preferred to that which is pasteurized. At the same time if the character of the milk is doubtful, as it may be in cities, it may be desirable to pasteurize it. The process is that of heating the milk to a temperature of 167° F., for a period of twenty minutes, this intended to destroy most of the germs causing intestinal diseases in children, without seriously impairing the food value of the milk as would be the case if it were sterilized by boiling. Boiled milk is unfit for infants. Pasteurized milk will keep much longer than ordinary milk.

If there is any special reason for using pasteurized milk, the process can be accomplished at home in a very simple manner. The baby's food should first be bottled in the clean nursing bottles in the quantities required for each feeding, and these bottles should then be placed upright in a pot or pail of water. A false bottom should be placed in this pot or pail, so that the milk bottles will not rest directly

on the bottom. This false bottom may consist of a small section of half-inch mesh wire netting, or may be made by puncturing fairly large holes in a pie-tin or shallow pan which is then placed upside down in the pot, the bottles resting upon it. The water should come up to the level of the milk in the bottles, and a thermometer, placed in the water, between the bottles, and also standing upright, will register the temperature. The water should be heated 165° to 167° F., whereupon the whole should immediately be taken from the stove and placed in a fireless cooker or wrapped around well with blankets or heavy cloths to retain the heat. After twenty minutes take out the nursing bottles, and after cooling by placing the bottles in cold water, place in a cold refrigerator until used.



This simple apparatus is designed for Pasteurizing milk at home in case the milk is of doubtful quality. The milk, modified as desired, is first bottled in quantities required for each feeding, the bottles then being placed in a pail or pot of water, the water line even with the top of the milk in the bottles. The bottles should rest upon a false bottom made by a pie tin or shallow pan punctured with holes and inverted, as shown in the smaller figure underneath. A thermometer is placed perpendicularly in the water among the bottles as shown. The water is then heated to the desired point (150 or 168° F.), whereupon the whole is removed from the fire and wrapped in warm blankets or other coverings to preserve the temperature for twenty minutes. Cool bottles in running cold water and place in refrigerator.

Milk is sometimes pasteurized at a lower temperature, for instance 145° to 150°, which is perhaps just as satisfactory in most cases, and less inclined to impair the quality of the milk.

Condensed milk seems to be fairly satisfactory in some cases. Unsweetened "evaporated cream" is milk preserved without adding sugar. Only the best grades of condensed or evaporated milk should ever be used, for some are made up from skimmed milk. One may

naturally judge that the cheaper brands are of this class. An objection to some condensed milk is that there is too much cane sugar in it. It should be diluted from fourteen to seven times, according to the age of the infant, in order sufficiently to reduce the proteids, and the proportion of fat then becomes very much too low. Therefore condensed milk, if it must be used in feeding the baby, would be made very much more satisfactory by adding from one to two ounces of pure, fresh cream to each eight ounces of the child's milk, as it is diluted for feeding.

Older children also require a certain amount of care and discrimination in feeding. Errors of diet are detrimental at any time of life, but especially so in childhood. Perhaps the most common and serious of all these errors is persistent overfeeding, and the habit of eating between meals. Children should be restricted to a limited number of wholesome foods, for too great a variety and the use of fancy dishes will greatly impede their development and impair their health. Candies and confections should not be taken in excess. Rich desserts should be avoided.

Milk should be used freely throughout childhood. It is regarded as very important food until the child is supplied with a full set of teeth. Milk should always be given from the bottle. Meat may be used occasionally where there is a craving for it. In fact an exclusive meat diet is sometimes of great value in treating childish disorders in which an exclusive milk régime does not seem to prove effective. In addition to the use of milk the best foods for childhood are fruits, which should be used freely, eggs, whole wheat bread, cereals and vegetables. Cereals, served with cream or mixed milk and cream, should be used without sugar. They may be sweetened with dates or raisins, or perhaps with honey. If sugar is desired, brown is the best, though molasses is still better than sugar. Honey is a splendid and healthful sweet, while dates, figs, raisins and other sweet fruits may be depended upon for supplying the sweets demanded in childhood. It would be better if sugar were eliminated entirely.

The second year will require the continued use of milk, as already suggested, and this should preferably be taken in a bottle so that it will be consumed very slowly. Orange juice should also be given freely (not necessarily at the same time as the milk). Strained orange juice may be given in the latter half of the first year, also, if the child likes it. The white of the egg, very slightly cooked, as by a little boiling or steam-poaching, may be given during the last three

months of the first year and the first few months of the second year, and after that the entire egg. Coddling is a satisfactory method of preparing an egg, placing in boiling water and immediately taking off the fire, to stand for five or six minutes, after which the contents will be nicely jellied but not too hard. A still better method is to place the egg in cold water, then place over a fast fire until the water comes to a boil, at which point immediately take out the egg and immerse in cold water to stop further cooking.

Cereals may be given with a spoon after six months. Later on, whole wheat bread toast may be given at the same feeding, without butter. This, or zwieback, may be given first in the meal, to chew on, the egg or cereal and the milk to follow. Orange juice may soon be supplemented by other fresh fruits, or preferably their juices, strained. The child will be ready for vegetables before it is a year old, when such vegetables as white potatoes, squash, spinach, asparagus tips and peas may be used, at first in moderate quantities. Vegetables more difficult to digest should be avoided in the early years of childhood. (See Vol. I.)

Four meals only should be given in the second year, and one or two of these simply a feeding of milk, modified or not as may seem best. Three meals will prove satisfactory in many cases, and should be observed after the second year, without any piecing between meals. Two meals may be a better arrangement in later boyhood and girlhood.

The third year. and after the range of foods can be gradually extended, but always avoiding white bread, pastries, cakes and other white flour products, and still observing simplicity in the menu. Vegetable soups will be of great value, such as purées of peas, asparagus, celery, beans and the like. These are made very tasty with tomatoes, onions and other natural appetizers. Baked beans later on will provide a very hearty and strengthening food, baked with olive oil or butter instead of pork. Nuts may be used as soon as the teeth are well formed and the child is able to fletcherize them, but they should be used as food at meal times only, and never as delicacies between meals. It is most important that they be thoroughly chewed, and if the child cannot be taught great thoroughness in this respect it may be better to avoid them during the second and third years. They are very rich and nourishing, however, and if they agree will be valuable childhood food.

Desserts should be restricted to the most plain and simple varieties. Raisins, dates, figs and various fresh fruits and fruit purées are the

most satisfactory of all, though baked apple, without sugar or cream, is splendid. Apple sauce, stewed prunes, apricots, or other stewed fruits, rice pudding, tapioca puddings, plain custard, and other desserts of this kind may be recommended. A very little pure, home-made ice-cream may be permitted at intervals of several days.

Beverages should be restricted to water and milk, though the latter is rather a food than a beverage. Milk should always be warmed a little during the second and third years, in order not to chill the stomach and interfere with perfect digestion. Ice-water should be strictly avoided, or any very cold water or food.

Children should never be urged to eat, and should not be asked to eat anything which they do not enjoy. Gluttony is a habit easily acquired and should be discouraged. Sweet things, if included in a meal, should not be given until after the simple, substantial foods have been finished, for if given first they will clog the natural appetite. Unpleasant topics of conversation should be avoided at the table, and above all things, children should be taught to masticate to the limit. If there are several children, get them interested in trying to see which can masticate his bread the longest. Never permit haste at the table, and do not let "wash down" any food by liquids. (See also the general discussion of *Diet* in a previous volume.)

Genitals, Care of.—The care of the genital organs in infancy is summed up in strict cleanliness, which applies equally at all times of life. The parts should be washed every day with the aid of fresh absorbent cotton, each piece being thrown away or burned without using a second time. Boric acid should be used, and the parts should be washed several times daily if there is any inflammation or discharge. In handling girl babies, great care must be used to avoid irritation or infection from soiled diapers. Immediate and thorough washing is desired on all such occasions. In male infants, the foreskin or prepuce should be pushed back for thorough but gentle washing.

Lack of care may lead to a degree of irritation which will develop the habit of masturbation. For this reason the washing must be thorough. There are a few cases, among female infants, in which a hooded clitoris may require an operation similar to that of circumcision.

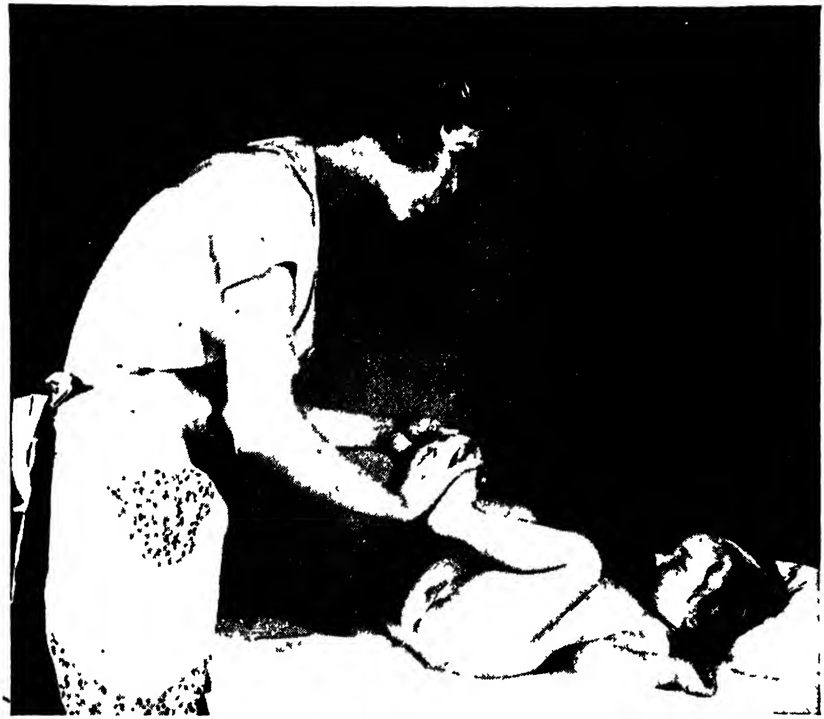
Circumcision may be advantageous in a limited number of cases, but as a general thing is not necessary. (See reference to *Phimosis* and to *Circumcision* in Vol. II, pp. 1118, 1139.) It there is an adhesion it may usually be overcome gradually by the gentle pressure of water or boric acid, introduced by means of a small syringe into the space

between the prepuce and the glans, through the regular opening of the prepuce. This treatment offers the best means of dilatation, and should be practiced daily until the difficulty has been remedied.

Growth and Development.—*The weight* of a child is the most important indication of its proper growth and welfare, and should be noted from time to time, preferably once each week in the early months. Normal babies may weigh from six and a half to fourteen pounds, though the average normal weight is about seven and a half pounds, with girls a trifle lighter than boys. Most of the stories of great weight in babies are simply the expression of the enthusiasm of fond parents.

There is usually a decrease in weight of perhaps a half pound during the first few days, because alimentation is not immediately established, and there is some loss through the passage of urine and meconium. But after the first week the child should gain from five to eight ounces each week for the first six months, and after that perhaps a quarter of a pound each week until the end of the first year. The normal infant of average weight will usually double its weight in the first five months, and treble it by the end of the year. Bottle-fed babies are thought usually to gain less rapidly than those breast-fed, but either one should weigh from twelve to thirteen pounds at three months, fifteen to sixteen pounds at six months, seventeen to eighteen pounds at nine months, and twenty to twenty-two pounds at one year. The gain may be irregular when teething, but any other variation from the usual gain should be considered. There is sometimes a rapid gain in weight on patented food without a satisfactory gain in strength or in other

Correct and incorrect outlines of infants' shoes. The figure to the left shows a type of shoe, quite common, in which both shoes are the same, and which, as dotted outline indicates, does not conform to the shape of the foot. The figure to the right shows a better outline, with distinct right and left shoe for right and left foot.



The child may be introduced to exercise by such simple movements as pushing the knees upward and pulling the legs out to full length in turn. This may be continued as long as the child continues this movement with interest and without growing tired.

respects. Remember that exceptional fat is not desirable in infancy any more than at any other time of life, although the normal infant is naturally smoothly rounded and plump.

Regarding later childhood development, we may say that the weight, taken at one year, is approximately doubled at five years, and this again is approximately doubled at twelve years. There are naturally many variations from the average standards, and without indicating any abnormal condition, except where there is a failure to gain steadily in the first year or a marked discrepancy in the later years. Remember that the figures in the accompanying table are general, or average, and cannot be expected to apply to all individual cases, even when they are normal and healthy.

The height of a normal child born at full term is from nineteen to twenty inches, with girls perhaps very slightly shorter, on an average.

As a rule one may expect a gain of from seven to nine inches the first year, about four inches each the second and third years, and after that about two inches per year on an average until reaching the final stature, though sometimes with greatly marked variations in this respect.

AVERAGE GROWTH DURING FIRST FIVE YEARS

Age	Height	Weight	Age	Height	Weight
Birth	19 in.	7½ lb.	9 Months	25½ in.	18¾ lb.
1 Month	20 "	8¾ "	10 "	26 "	19½ "
2 Months	21 "	10¾ "	11 "	26½ "	20½ "
3 "	22 "	12¼ "	1 Year	27 "	21½ "
4 "	23 "	13¾ "	2 Years	31 "	27 "
5 "	23½ "	15 "	3 "	35 "	32 "
6 "	24 "	16 "	4 "	38 "	36 "
7 "	24½ "	17 "	5 "	41 "	40 "
8 "	25 "	18 "			

The chest measurement is perhaps more important than the length or height of the child, and its growth should be noted every few months. The average normal chest measurement at birth is about thirteen inches and should gain about four inches during the first year. By the third year the chest should be considerably larger than the head.

The circumference of the head at birth in the average case is between thirteen and a half to fourteen inches, growing some four inches during the first year and after that a half inch each year for twelve years. The lower jaw is much undeveloped at birth, and consists of two bones which grow together into one during infancy. At the top of the head near the front and at the back are two spots which at birth are not covered by bone, but only by a membrane and the skin. These are called *fontanelles,* through which the pulsations of the brain may be felt. Care should be used that the baby will not be struck on the head at these points. In the course of the normal development of a well nourished child, these fontanelles should be closed by the formation of bone tissue at any time from one year to a year and a half of age. All of the bones of the new-born infant are largely cartilaginous, gradually hardening with the increasing deposits of mineral matter. (See also *Teeth in Childhood,* this chapter.)

The normal condition and growth of a child may be determined somewhat by its progress in learning the use of its muscles, in sitting up, creeping, walking and playing Remember, that some children develop more slowly than others in these respects, and, other things being normal, there is no reason for alarm if one child is more tardy than another in certain activities.

The normal child will usually hold up its head at three or four months, sometimes much earlier if properly clothed so that it has perfect freedom of movement in which to develop its muscles. The baby may be expected to smile at about four weeks and to laugh out loud at from three to five months. At five to seven months it will reach for toys and handle them, and at six or seven months will sit up erect without support. The normal child usually creeps at eight or nine months, at nine or ten months it tries to stand with the help of a chair, walks alone at about one year, and runs at about fifteen or sixteen months, seldom falling. The child should not be urged to walk, for it is a matter of growth, both in mental coordination and in strength of bone and muscle. Particularly should large and bony babies not be encouraged to be on their feet before their natural impulses prompt such activities

At one year the average child will say "Papa" and "Mama" and

The play-pen, or similar enclosure, however simple, affords the child opportunity for movement and activity, with safety, important in early growth and development.

perhaps a few other single words, while a child of two years will put them together in short sentences.

Holding the Baby.—See *Carrying the Baby.*

Mouth, Care of.—Though Nature has provided for keeping the mouth clean by means of the saliva, yet in early infancy the secretion of the latter is so limited that special care is desired in keeping the mouth clean and wholesome. *Sprue* or *thrush* is entirely the result of uncleanliness, and should be treated with repeated washings of the mouth with boric acid. (See Vol. V for detailed discussion of this disease.)

The baby's mouth should be washed daily, most conveniently after the general bath. If a finger is used in washing it, the little finger is preferred, wrapped around well with absorbent cotton or a soft cloth. Either boric acid or salt water should be used, in the latter case employing a weak solution, a pinch of salt to a glass of boiled water.

Navel, Care of.—In the care of the navel at birth it is well to do as little as possible after it is first dressed, and this first dressing should be very simple. It is desired that the cord shall dry up, and this naturally requires that it be kept as dry as possible. It should not be touched during the first week when bathing the rest of the child, unless the dressing is wet with urine.

In dressing the cord, a pad of antiseptic absorbent cotton wrapped in sterile gauze may be placed around the navel fairly close, the cord then being laid over this upward and to the left side, after which another pad of the cotton may be laid over it all, then held in place by the regular flannel band, described under *Clothing,* which, however, should not be fastened too tightly. It should only be strong enough to hold the navel dressing in place. After the cord falls off, which is usually in five to seven days, a dressing of antiseptic cotton may be continued for a few days until the parts involved have thoroughly healed.

If there is bleeding from the stump of the cord, another tighter ligature should be tied around it. If the navel is moist and inflamed, or if there is a discharge, either before or after the cord drops off, it may be dried up by dusting with some antiseptic powder twice a day, for instance, boric acid, or mixed boric acid and starch.

Rupture or hernia of the navel is occasionally met with in young infants. It is a grave mistake to fasten abdominal bands tightly with a view of supporting the abdomen or preventing rupture, for the

pressure upon other parts of the abdomen is very likely to cause just such a rupture at this point. (See *Rupture in Infancy*.)

Nose, Care of.—Breathing is the most vital of our activities, and it is important that the habit of nasal breathing should be established from earliest infancy. Upon this depends not only the satisfactory oxygenation of the blood, but also the prevention of adenoids and other disorders. The nostrils should therefore receive attention each day, following the bath, along with the eyes, ears and mouth, and if clogged should be attended to many times each day.

Nothing hard and stiff should be used in cleaning a child's nostrils. The best plan is to take a wad of absorbent cotton and twist it into a small finger or cone perhaps an inch long, thus providing a soft and effective means of removing accumulated mucus. It is well first to use a cotton cone dipped in boric acid, twisting after inserting, to soften or moisten the membranes and mucus, after this using two or three dry cones, or more if necessary, to remove any accumulations. If there is mucus, it is well to put a drop of olive oil in each nostril to loosen it.

Nursery.—See reference to outdoor nursery under *Air*.

Nursing.—See *Feeding*.

Premature Infants.—A premature infant is one born before the expiration of the normal full term of 280 days. Those born at twenty-eight weeks or after have a good chance of living with proper care, and while those born at twenty-four weeks usually die within a few hours, yet have a possible fighting chance for life which should be made the most of. It is well in such cases to place the child in an institution where there are all conveniences for taking care of it properly, including the so-called "incubators," of the best types. But something should be known of the best immediate care in such cases.

Exposure is a serious thing to a premature infant. It should be wrapped immediately in soft warm flannel blankets and placed in a basket or other handy receptacle which has been lined with hot water bottles at bottom and sides, covered with generous layers of cotton-wool. If a regular incubator is available, so much the better, but it usually is lacking in the emergency. However, a home-made incubator may be improvised from a good sized wooden box or basket, the air being warmed by hot water bottles, heated bricks or flatirons.

The premature infant should not be bathed, for it has not sufficient vitality to recuperate. As soon as convenient after birth, and in a very warm place, the little body should be oiled with warm olive oil,

exposing only a part at a time, and then well wrapped around with warm absorbent cotton, the face only exposed. Separate pads of cotton should be placed at the groin and buttocks for convenient removal when wet or after a movement of the bowels. It is better to give no baths for several weeks, changing the cotton and applying olive oil fresh every other day. In the incubator it should be kept in an atmosphere that is pure, but warmed to a temperature of eighty-five to ninety degrees, or even a little higher if the infant is only a couple of pounds in weight, or born before seven months.

Feeding should be permitted at intervals of an hour and a half at first, the breast milk always preferable. It may be advisable to withdraw some of this by means of a breast pump and perhaps even then dilute it slightly with boiled water. If cow's milk must be used, it should be modified by diluting with even more water than suggested, under *Feeding,* for the use of an infant born at full term, for instance, two or three ounces of top-milk to fifteen ounces of boiled water and one ounce each of milk sugar and lime-water.

The premature infant should be handled as little as possible, and the aim should be to provide warmth, quiet and freedom from strong light, conditions which prevail in the natural environment of the infant before its normal birth at full term.

Rupture in Infancy.—Roughly speaking, there are three points at which rupture or hernia may take place in infancy, at the navel, in the groin and in the line between the navel and the lower end of the sternum. Other ruptures are possible, but extremely rare.

The upper picture shows appearance of umbilical hernia, or navel rupture. The lower figure treatment for retaining the rupture after it has been reduced, consisting of a round sterile button, placed convex side down upon the navel, and held in place by two strips of adhesive plaster.

Umbilical hernia, a protrusion of the intestine at the navel, is the most common variety of rupture in infancy. Owing to the fact that the large blood-vessels contained in the umbilical cord

enter and leave the body of the infant at this point during life before birth, there is considerable opening here, leaving this a comparatively weak point in the abdominal wall during the first few days or weeks after birth. Pulling on the cord during birth, distention of the intestines or even violent crying may result in rupture, though it is a very simple disorder and readily remedied by proper treatment.

It is above all things necessary to provide some support in the form of a pad to prevent the protrusion of the intestine after the hernia has been "reduced," or that is to say, gently pushed back into its normal place by manipulation. Elastic belts have been recommended, but are not generally satisfactory because of their tendency to constrict the entire abdomen. One of the best methods is to take a fairly good sized button with a convex face, and cover it with soft chamois skin, placing this over the navel and holding it in place with two strips of one inch wide adhesive tape crossing each other. If this is loosened in four or five days it should be renewed, with a new clean button. If the adhesive tape seems to irritate the skin, then apply olive oil to the irritated part and shift the new tape to a different position. In other words, if the first dressing has the two strips placed one horizontally and the other vertically over the stomach, the next dressing can have the two strips running diagonally across the stomach. In applying the button, it is kept convex side downwards.

Another satisfactory treatment consists of the use of a single adhesive tape. Having reduced the rupture, the skin from both sides is stretched toward it, forming a deep fold of skin over the navel. This practically forms a pad of flesh or skin, and it is held in place by the adhesive plaster applied first on one side and then on the other, while the fold of skin is held in place. Either of these treatments must be kept up persistently, without allowing the rupture to protrude at any time, and as soon as possible exercises which strengthen and develop the muscular walls of the abdomen should be given. In the rapidly growing structures of a young child's body a rupture will mend very quickly.

Ventral herniae are not very common but should not be neglected when discovered. They occur along the middle line of the body between the navel and the breast bone, though sometimes below the navel. They are usually very small, sometimes only the size of a pea, and may be overlooked or mistaken for some other form of simple growth or tumor. They may be recognized from the fact that they

disappear under pressure. They may be painful. The cure consists of mechanical support such as that for umbilical hernia, together with exercise to strengthen the muscles and thicken the abdominal walls until the opening closes up naturally.

The groin may be the seat of *inguinal rupture* in infancy or childhood as well as in adult life, though as a rule only in males. Sometimes the inguinal canal does not close as well as it normally should after the descent of the testis from the abdominal cavity into the scrotum, and in such a case a hernia is more likely. When the loop of the intestine even descends into the scrotum it is a *scrotal hernia.* The nature of inguinal and scrotal hernia is made clear in the discussion of *Rupture* in Volume II.

Inguinal or scrotal herniae usually are recognizable by the possibility of reducing them with a little very gentle manipulation, the patient lying on his back. It may be distinguished from hydrocele by the fact that, in reducing, it finally goes back quickly with a gurgling sound. Hernia gives an impulse when coughing that may be distinctly felt, hydrocele does not. On light percussion, a tumor from hernia is resonant, hydrocele dull. A hernia is opaque to transmitted light, hydrocele translucent.

These ruptures are readily cured in infancy by means of exercise because of the rapid development and growth of all tissues during the first year. The part should be thoroughly protected with a well-fitting truss, however, and one should have changes of this for the sake of cleanliness. Usually a covering of india rubber is desirable to avoid wetting with urine.

Femoral hernia is seldom found in infants.

A congenital hernia is a form of inguinal hernia in which the vaginal process of the peritoneum has remained open, so that the intestine descends directly into the scrotum in contact with the testicle. By suitable and very gentle manipulation this may be reduced the same as other inguinal herniae and held in place by a properly fitting truss.

It is always imperative that a rupture of any kind should be reduced and properly supported. Sometimes it will not occasion any pain or special inconvenience, but it must not be neglected either then or under any other circumstances. If it is found to be irreducible, the help of an expert should be secured.

It sometimes happens that infants are supposed to be suffering from colic when they are the victims of hernia, perhaps constricted. It is

well, therefore, to make a careful abdominal examination from time to time, and especially in case of much crying and suspected colic.

Constipation seriously aggravates any form of hernia. and any tendency in this direction should be carefully and thoroughly combated.

Sleep.—The growth of a child is very rapid the first few months, doubling its weight in five months. Because of the rapid tissue changes, sleep is all-important. Growth depends largely upon sleep at this period. In the beginning the baby should sleep almost all the time, perhaps twenty-two or twenty-three hours out of the twenty-four. After a couple of months it should sleep from fifteen to eighteen hours. Between one and two years of age there should be a sleep of at least ten hours at night and two to four hours in the afternoon, this afternoon nap to be continued, if possible, up to the age of four or five years. During this entire period, growth, appetite and vitality depend very largely upon this afternoon nap, for the mere sleep at night is scarcely sufficient. Even up to ten or twelve years of age it is well to make certain that the child will have at least ten hours of sleep at night. The windows should be wide open, if necessary using extra covering in winter to make certain of warmth.

Regular hours for sleeping are important during both infancy and childhood. The child should not be rocked to sleep, but should be placed in its bed at the proper time, and if trained in this way will go to sleep naturally. Sometimes it is only necessary to change the position to make the baby comfortable.

Most parents during the first few months of their child's life *teach* it to cry for what it wants, forgetful of the fact that of all of earth's lessons this is one of the hardest to unlearn, and yet one that inexorable necessity demands that we unlearn. The mother who feeds her child every time it cries; the father who gets up at all hours of the night and carries his child to and fro in his arms; the friends who give to the child whatever he asks for when he cries; the nurse, who, to quiet the child's screaming, picks up a toy twenty times in succession, simply to see the child throw it down again, are pitiable fools and unkind to the child, in that they are training him to a habit a cruel and relentless world will compel him to break later on at a cost of many bitter tears and hours of agony.

In these early months you are the one to know what the baby needs. His body demands food, but only at certain intervals. Teach him from the start he cannot have it at any other time than those intervals, and that *crying never brings it.* If he cries at the time of feeding,

soothe him and get him quiet, at all hazards and costs, *before* you feed him, and the lesson once learned he will never forget.

All reasonably healthy children should sleep through the whole night without food, after the first month or two. Begin by putting him in his own cot, *awake,* and then if he cries in the night, see that he is clean and comfortable, change his position, give him a spoonful of cold, pure water and put him back again.

At the outset teach your child, where possible, to sleep alone, upon a hard mattress, without a pillow if possible and if with one let it be as small a one as can be obtained. The less covering on the bed the better, provided there is warmth enough. Children may be taught to sleep in "the altogether." Nightgowns are unnecessary and the more freedom the skin of the child has the more hardy it becomes. Whenever it can be so arranged let the child sleep out-of-doors from its birth. In the city or in the country this is always an advantage.

Sun-Baths.—See under *Bathing*.

Teeth.—The first set of twenty teeth, or the "milk-teeth," are already in existence in an embryonic form at the time of birth, their formation having commenced early in fetal life. Occasionally a child is born with one or two teeth already cut through the gums. As a rule, however, dentition or teething begins at six or seven months and ends at about two years, with ten teeth in each jaw. According to their development they usually appear in groups, the first *two lower incisors* at six to eight months, the *four upper incisors* at eight to ten months, the *two lateral lower incisors* and *four first molars* at about one year or a little later, the *four canines or eye teeth and stomach teeth* at about a year and a half, and the *four second molars* at about two years or a little later.

Teething sometimes gives rise to considerable disturbance of the nervous system as a result of the irritation, thus affecting the appetite and functions of the body generally. As a rule, the more healthy and vigorous the child, the less trouble. If the appetite fails, do not attempt to enforce feeding. Even a fast of one day will often be advantageous. Give plenty of pure, cool water.

The gums, naturally a pale pink in color, become red and swollen when teething. Lancing is often practiced to give relief, but is not advisable except in unusual cases. It is better to leave the process to Nature, and to permit the child to bite on suitable hard objects as much as he pleases.

A healthy child will sometimes cut teeth without any trouble what-

ever. Sometimes disorders due to improper feeding or other sources are mistaken for the results of teething.

Sometimes the first tooth does not appear in the first year, and though this is often the result of imperfect nutrition or retarded development, perhaps following some severe infantile illness, yet it does not always indicate anything abnormal and need not occasion alarm if other conditions are quite normal.

At about the sixth year four additional molars are added, the "first molars" of the permanent teeth. At this time also the temporary teeth commence to fall out and to be replaced by the permanent teeth, in the order of the first appearance.

At the age of twelve the second dentition of childhood is completed, with twenty-eight teeth. The four remaining molars of adult life, the so-called "wisdom teeth," arrive at or near maturity, varying in different individuals from the age of seventeen to twenty-five years.

Temperature.—The temperature of an infant is likely to vary more than that of an adult and without indicating an abnormal condition so serious as a similar variation in the temperature of an adult. In a child it is a prolonged high temperature that indicates serious trouble rather than its mere elevation for a few hours.

The baby comes into the world with a temperature of about 99° F., which within an hour, as a result of the changed environment, drops two or three degrees, sometimes even to ninety-five. It soon rises again, however, and after regular feeding is established it remains between ninety-eight and ninety-nine degrees, usually dropping about one degree at the time of the daily bath.

Training the Child.—It is one of the purposes of this set of books to dispel superstitions with the light of truth, to impress upon mothers and others responsible for the care of children their responsibilities, and to show them how simple are Nature's laws and how easily they may be applied to the care of children.

A child cannot defend himself as can the young of other animals. He is helpless and at the mercy of his caretakers. He can be assisted to grow strong and sturdy, or he can be so injured in the first few weeks of his existence that, even if he survives, he can never attain his normal development, nor live out his normal span of life.

Some mistakes can be corrected, but, unfortunately, this is not true of all. Therefore it behooves the mother to see that the child has everything it needs for its growth and development, and that it is protected from everything which might injure its health.

Nearly all the mistakes made by the average mother in the rearing of her children are due to delusions that are as ancient as they are persistent. Even those parents who recognize the errors of the prevailing system, often lack the courage to put their beliefs into practice.

The child is a part of Nature—nothing supernatural, nothing beyond the influence of Nature's laws. But, though much study has been devoted to the feeding, housing and general care of other animals such as horses, cattle, and sheep,—that their health may be maintained and their purpose in life carried out to the fullest extent, a child, perhaps in the home of one who is making such studies, may die for want of the practical attention given to these creatures.

The child needs more care in the selection of its diet and the regulation of the other conditions of its life than any other animal requires, because of the fact that previous generations have handed down to it the tendency to weakness and disease.

A child is more active for its size than any adult—it expends more energy for its weight in a given time than does an adult. Therefore it is detrimental to health and growth to in any way restrict its physical activity.

Recuperative powers are great in the child, and, if it has previously received proper care, will, if given a chance, quickly restore it to health in case disease develops.

Giving it a chance does not mean unnatural treatment by medicine, coddling, etc. The vital force within the little body will be either depressed by this treatment or over-stimulated, and the depression or stimulation may be sufficient to overpower the vital force and snuff out a young life at its beginning.

It has been the purpose in preparing this book to present the safest and most effective means of preserving and restoring health in infancy and childhood. The material is based upon experience and observation of many physicians and scientists who have viewed the disorders of infancy and childhood as disturbances of health resulting naturally from removable causes, rather than as outside conditions which appear "out of nowhere" for the purpose of harassing the innocent ones.

Viewed merely as a remediable disturbance of the health-maintaining functions, ill health is a comparatively simple matter, and not the highly complex subject one is led to believe by the old school of medicine—which has not studied health in children or adults, but disease and ill health alone.

Numerous "Don'ts" could be listed here, but the endeavor has been to point out the substitutes for "Don'ts." Modern psychology has shown that we are inclined to do what we are told not to do. Instead of "Don't," we have tried to say "Do." We have endeavored to present the proper way of caring for children and if the instructions here given were generally followed, the result would be greater health and freedom from disease for all children.

(End of Volume I)